BEATING THE COMPETITION AT OUR OWN GAME: TECHNOLOGY-BASED ADVANCES IN MANUFACTURING

HEARING

BEFORE THE

SUBCOMMITTEE ON
INVESTIGATIONS AND OVERSIGHT

OF THE

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRD CONGRESS

SECOND SESSION

JULY 7, 1994

[No. 171]

Printed for the use of the
Committee on Science, Space, and Technology

U.S. GOVERNMENT PRINTING OFFICE
87-667 WASHINGTON : 1995

For sale by the U.S. Government Printing Office
Superintendent of Documents, Congressional Sales Office, Washington, DC 20402
ISBN 0-16-046952-X

BEATING THE COMPETITION AT OUR OWN GAME: TECHNOLOGY-BASED ADVANCES IN MANUFACTURING

HEARING

BEFORE THE

SUBCOMMITTEE ON
INVESTIGATIONS AND OVERSIGHT

OF THE

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRD CONGRESS

SECOND SESSION

JULY 7, 1994

[No. 171]

Printed for the use of the
Committee on Science, Space, and Technology

U.S. GOVERNMENT PRINTING OFFICE

87-667 WASHINGTON : 1995

For sale by the U.S. Government Printing Office
Superintendent of Documents, Congressional Sales Office, Washington, DC 20402
ISBN 0-16-046952-X

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

GEORGE E. BROWN, JR., California, *Chairman*

MARILYN LLOYD, Tennessee
DAN GLICKMAN, Kansas
HAROLD L. VOLKMER, Missouri
RALPH M. HALL, Texas
DAVE McCURDY, Oklahoma
TIM VALENTINE, North Carolina
ROBERT G. TORRICELLI, New Jersey
RICK BOUCHER, Virginia
JAMES A. TRAFICANT, JR., Ohio
JAMES A. HAYES, Louisiana
JOHN S. TANNER, Tennessee
PETE GEREN, Texas
JIM BACCHUS, Florida
TIM ROEMER, Indiana
ROBERT E. (BUD) CRAMER, JR., Alabama
DICK SWETT, New Hampshire
JAMES A. BARCIA, Michigan
HERBERT C. KLEIN, New Jersey
ERIC FINGERHUT, Ohio
PAUL McHALE, Pennsylvania
JANE HARMAN, California
DON JOHNSON, Georgia
SAM COPPERSMITH, Arizona
ANNA G. ESHOO, California
JAY INSLEE, Washington
EDDIE BERNICE JOHNSON, Texas
DAVID MINGE, Minnesota
NATHAN DEAL, Georgia
ROBERT C. SCOTT, Virginia
XAVIER BECERRA, California
PETER W. BARCA, Wisconsin
BOBBY L. RUSH, Illinois

ROBERT S. WALKER, Pennsylvania*
F. JAMES SENSENBRENNER, JR., Wisconsin
SHERWOOD L. BOEHLERT, New York
TOM LEWIS, Florida
HARRIS W. FAWELL, Illinois
CONSTANCE A. MORELLA, Maryland
DANA ROHRABACHER, California
STEVEN H. SCHIFF, New Mexico
JOE BARTON, Texas
DICK ZIMMER, New Jersey
SAM JOHNSON, Texas
KEN CALVERT, California
MARTIN R. HOKE, Ohio
NICK SMITH, Michigan
EDWARD R. ROYCE, California
ROD GRAMS, Minnesota
JOHN LINDER, Georgia
PETER BLUTE, Massachusetts
JENNIFER DUNN, Washington
BILL BAKER, California
ROSCOE G. BARTLETT, Maryland
VERNON J. EHLERS, Michigan

ROBERT E. PALMER, *Chief of Staff*
MICHAEL RODEMEYER, *Chief Counsel*
KATHRYN HOLMES, *Administrator*
DAVID D. CLEMENT, *Republican Chief of Staff*

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

JAMES A. HAYES, Louisiana, *Chairman*

JOHN TANNER, Tennessee
MARILYN LLOYD, Tennessee
DON JOHNSON, Georgia
SAM COPPERSMITH, Arizona

CONSTANCE A. MORELLA, Maryland
JOE BARTON, Texas
VERNON J. EHLERS, Michigan

---

*Ranking Republican Member.

CONTENTS

WITNESSES

APPENDICES

BEATING THE COMPETITION AT OUR OWN GAME: TECHNOLOGY-BASED ADVANCES IN MANUFACTURING

THURSDAY, JULY 7, 1994

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
Washington, DC.

The subcommittee met, pursuant to call, at 10:11 a.m., in room 332, Rougeou Hall, the University of Southwestern Louisiana, Lafayette, LA, Hon. James A. Hayes (chairman of the subcommittee) presiding.

Mr. HAYES. Good morning. We are going to open our hearing on the Subcommittee on Investigations and Oversight.

Before I go into any opening statements or comments, I would like to turn the hearing over to Carl Bauer, which is certainly a mistake of judgment on my part, but nevertheless one that I hope will give him an occasion to welcome those of you who are not from our community, to both Lafayette, Louisiana and the facility here at USL. Carl Bauer.

Mr. BAUER. Good morning, former Congressman Hayes. [Laughter.]

In all seriousness, Congressman, Secretary Reilly and distinguished panelists, on behalf of Dr. Authement, the President of the University, we sincerely welcome all of you and our guests to the University, to Lafayette, to Louisiana. For those visiting us from out of state, we are excited about this hearing, we think it is a big day for the University, certainly for Lafayette and for Louisiana, and we are just excited to have Congress come to Lafayette and particularly our distinguished panelists. I know that the Congressman has a great deal to say—he always does—but we are excited to have him here too and back home really.

Welcome to Lafayette and particularly to USL.

Mr. HAYES. Thank you very much.

Also as a matter of housekeeping, I want to place into the record a letter that we received from Congressman Richard Baker, Louisiana Sixth District. I have invited Congressman Baker to attend this hearing, giving me a Republican and Democratic member. He had other obligations which did not allow him to attend, but he has sent a letter which I am going to read part of.

Part of the text says,

Judging from the list of witnesses you have assembled, I am certain that you will have a productive morning. Fruit of the Loom and Northrop/Grumman have both contributed a great deal to the economy of our state and their input is critical if

we are to find a way for government and academia to make greater contributions toward utilizing new technologies.

The federal witnesses, Dr. Marsh from NSF, Mr. Carr from NIST, Mr. Lewis from DOE, will no doubt be impressed by the excellent facility that Al Steward heads at USL.

As the title of your hearing suggests, we must beat our foreign competitors playing by our rules, not theirs. Thankfully, we will not ever see Americans working at $5.00 a day, but in order to compete with less developed countries, we need apply manufacturing and technological innovations that are being developed every day in our country.

I appreciate Congressman Baker's participation in that manner, and I also very much appreciate the ways that we have been able to work together across the aisle and allow us to further the interests of the state of Louisiana.

I have an opening statement that I am going to place in the record, but I am not going to repeat it because I would rather have the opportunity greater afforded through our limitations on time to the witnesses that we have today.

The only statement that I will make is that the theme of this hearing and the witnesses that we asked to participate are geared toward showing that the role of the university in America has changed. It has been an evolutionary process that has brought it from a pure academic and pure science configuration to one of the applied sciences and one of using it as the laboratory for the ability to transfer technology.

When I was a student at this University in the 1960s, the object of the federal role, through the development of the space program and through strong defense budgets, was to use technology development at the cost of government where individual companies could not afford to do so, and then to drift that technology down into the marketplace. We have indeed turned that world upside down, both with constraints on federal budgets and with the partnerships created between pinpoint technologies at university centers and individual industrial needs. We are now, in effect, creating a technology at that level that government can then pick up down the road at a lower cost. And we are partnerships with federal agencies become partnerships at the beginning, not passed down with an end product. This is the technology of the future. This is the evolution of the university role.

And the citizens of this community should recognize, as should citizens of every community with a college in their midst, should recognize that it is the best industrial resource in the parish, in the area, in the state. And I hope to use the focal point of these hearings to send that message, not only as a repeat to the businesses that have been so cooperative and so helpful in the partnerships with the universities and through the federal agencies, but to those businesses that have changed their configuration as a result of changed economic circumstances that have broadened their industrial base and that need to know that they have a huge asset at their disposal and that they need to know that the opportunities for their own partnerships with this University, with government, educational institutions and the advent of transferring technology are there for them to take advantage of.

It is also my pleasure to introduce our first witness, whom I have known a long time, Mr. Reilly, who was a friend of mine before he

was Secretary, he still is, and in politics that is a great accomplishment.

The Louisiana Department of Economic Development is right up his alley, he has a tremendous business background and he is one of those folks that we like to take advantage of in state government and have them give far more than they get, I assure you, through his individual expertise and his individual dedication to economic development in this state.

So I want to congratulate you on a job that I think has been outstanding and the benefits of which this state is continuing to reap, and welcome you this morning to USL and appreciate very much your remarks and participation at our hearing.

[The prepared opening statement of Mr. Hayes follows:]

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, DC 20515

JULY 7, 1994

OPENING STATEMENT OF CONGRESSMAN JIMMY HAYES

CHAIRMAN, SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

Manufacturing industries have provided the path to the American Dream and a middle class life for millions of U.S. citizens, but over the past two decades we have seen a drastic decline in the number of people employed in manufacturing pursuits. This alarms me.

In his testimony, Mr. Steward will tell us that 428,000 jobs have been lost in the textile/apparel industry alone, and we all know of layoffs due to defense conversion. In South Louisiana, we also have seen hundreds of thousands of jobs in the oil and gas industry lost due to competition from overseas and the deadly combination of high taxation and overregulation.

Today, we will discuss the means by which we can overcome this adversity and restore manufacturing to the state it was in when people of my generation came of age. Advances in technology are tools with which we can rebuild this nation's manufacturing base.

We are fighting for marketshare with foreign competitors who measure wages in pennies per hour rather than dollars per hour, and we should not even attempt to compete on their terms. We should, instead, make use of our strengths, which include the best transportation system on earth, greater worker productivity, and, most importantly, our technological superiority. The Federal government and research institutions must find a role that builds upon these strengths, while not creating new weaknesses.

We will hear from Mr. Van Weele and Mr. Wigodsky, who represent companies that are not only vital to the economic well being of Louisiana, but also our country. We should listen to their words because Fruit of the Loom and Northrop Grumman are leading the way in their respective industries. I would also like to welcome Mr. Moore home. Although he, too, is now forced to spend much of his time in Washington, I know he must be glad to be back near his home in Opelousas.

Our Federal witnesses, Dr. Marsh, Mr. Carr and Mr. Lewis will share with us their agencies' efforts to bolster manufacturing, and I am hopeful that they, like myself, will find today's session helpful and productive.

Bill Fenstermaker, who is leading the effort to expand Acadiana Hotlink, has, as President of the Chamber, provided the vision that will bring our area into the next century and help ensure our future economic well being. Mr. Cummins represents a group that is on the cutting edge of the topic that brings us here today, and, of course, without Al Steward and everyone else here at USL, this hearing would not be taking place. The A-CIM Center, and the many other components that comprise the University - which is, by the way my alma mater - have truly been an asset to our state.

I look forward to everyone's testimony, and I would like to welcome Secretary Kevin Reilly, who has graciously accepted my invitation to join us today. I hope that we do not take so much time as to prevent you from bringing a new company to Louisiana by the end of the workday.

STATEMENT OF HON. KEVIN REILLY, SECRETARY, LOUISIANA DEPARTMENT OF ECONOMIC DEVELOPMENT, BATON ROUGE, LA

Mr. REILLY. Jimmy, thank you.

I would like to add my words of welcome too, to the representatives of the various federal agencies that are here and also the Committee staff that are visiting Louisiana.

Although we are relative newcomers to the programs that are available to states through the various federal agencies and laboratories, I am pleased to share with you the perspective of the state, so that we might join with Louisiana manufacturers and our university-based research community so that they may meet the challenges of the marketplace that Jimmy just described, that are going to be with us for the 21st century.

I looked at the correspondence concerning this meeting and we were trying to emphasize the two industries, both textile and aerospace. In both areas I think we have been rather successful lately in Louisiana.

I will give you just a brief idea of some of the progress we have made. We have had—probably when Fruit of the Loom ends up their—completes their operation up in Vidalia, they will be our largest civilian employer. Furthermore, we have been able to make some strides with various specialty niches, such as Holloway Sportswear that make these sports outfits for high school and college teams.

There are some pitfalls in this area though that I think I should point out. And that is that it is a very, very competitive area. I have been very disappointed in dealing with some of these manufacturers in that they tend to want to exploit our labor rather than to grow with it, far different than the attitude of Fruit of the Loom and Holloway Sportswear, among others.

When we get into one of these bidding contests, nobody wins really because we are looking at a situation where a company will come down and they will start throwing their weight around and we will give them the moon, and then they will tell you, well you had better do that because we are going to give you 2000 jobs and by gosh, that is what you need, is jobs. Well that is true, but when you look at those jobs, they are somewhere between $13,000 and $14,000 a year and they come very close to being the sweatshops that we do not want. So there are some pitfalls involved in this situation, but we have made some great strides.

As I say, we in the economic development area, operate these development programs with the sole premise really that our role at the state level should be one of support, and not hindrance, to motivation and certainly not over-regulation. We believe in listening to our customers, and our customers are people who are working at the local level, whether it be in government or in private economic development activities, such as the Chamber of Commerce, et cetera. And also, the people who are the recipients of our efforts; in other words, industry and business.

In developing new programs or dropping old programs or adjusting to current ones, as Congressman Hayes pointed out, we look for ways that our manufacturing sector can compete more effectively in the regional, national and global economies. Government must

remember who is really doing the competing. It is private industry that is really on the firing line and it is private industry that makes this state and this nation one that provides economic opportunities, growth and prosperity for our citizens.

Government really does not produce anything. They are there to support and that is what we view our role as. Our role, yours and ours, should be one of agents of change. We must offer the nation's manufacturers, especially small to medium-sized manufacturers where the new job formations are, the opportunity to learn about and try new technologies, new solutions, new management techniques that can enable them to compete in the 21st century. Effective state economic development programs are based on an intimate knowledge of the needs of its manufacturers and how state policy may affect the competitiveness. There is a vast variance in state policies across the nation. We happen to be, I think, very good in not over-regulating our industries. I was advised recently that our in California, for example, in Los Angeles, for a person to go into a small business, it requires 11 separate permits. That to me would appear to be over-regulation.

We believe that Congress also should take a holistic view of the impediments to competitiveness, consult regularly with the states and then develop program delivery by two methods—directly by appropriations by the federal agency or to the states through block grants.

Since time is limited, let me give you a brief tour of some of the goals that we have set forth.

The state has a Memorandum of Understanding with both the Stennis Space Center in Mississippi and the Marshall Space Flight Center in Huntsville, Alabama. We have begun the development of one with the Johnson Space Flight Center. And the Department operates the Louisiana Tech Transfer Office, which is housed at Stennis. Since its inception in April of 1992, this office has served over 1400 clients. The management and staff at Stennis has been more than generous in providing assistance to us. They have been tremendously cooperative and as a result the efforts have been productive.

The Apparel Center for Integrated Manufacturing at the University of Southwestern Louisiana is currently partnering with the Department of Defense, Levi Strauss and Leadtec, Inc. under a Manufacturing Technology Program grant. Work being done by the A–CIM Center and by the U.S. Department of Agriculture lab in New Orleans are part of the reason that the apparel and textile industries are one of our state's largest target industries. And as I pointed out, Fruit of the Loom will, when they complete the Jeanerette expansion and also the Vidalia operation, will be our largest civilian employer. We currently have employed, both in the apparel and textile industries over 16,000 people. And we also produce nearly a million bales of cotton annually. And our target there is to try to see if we can get somebody interested in putting a spinning mill in and then going from there to weaving and from weaving, the next step to cutting and sewing. This is where you have the value added to our natural resource of cotton, and this is one of the things that we are really striving to do.

Our petrochemical industry, of course, produces dyes and materials other synthetic fibers. These factors give us the infrastructure to interest both domestic and foreign investors in Louisiana as a site for the spinning and weaving operations that I have just described.

Our aeronautics and aerospace industry employs about 4500 Louisianians. Martin Marietta Space Systems in New Orleans partners with us for specialized tech transfer. Of course, the Martin Marietta operation has been severely reduced, with the reduction in our space program. But they are still in business and they still hire a good number of people.

One of the things that many have criticized was the effort that we put forth to bring Boeing to the Chennault Air Base in Lake Charles. It was criticized because the effort was really only for about a five-year period, the contract was for five years. And the cost in some areas was considered prohibitive. I disagree violently with that because what we did with Boeing, we used them as, shall we say, a stepping stone. We developed an infrastructure that is unrivaled in the United States and indeed in the world, for repairing large aircraft. With the decline in the defense budget, we are going to have to make those aircraft, the large, particularly the large hauling aircraft, we are going to have to make them last and we are going to be doing a lot of overhaul and repair. And that is what Grumman is doing in Lake Charles now. They stepped into that facility simply because we had the infrastructure in place and above all the trained work force. We spent a considerable amount of money, I think over $4.5 million training that work force, but we have the best aircraft maintenance and repair people, I think, in the United States now. And it was proven when Grumman stepped into the situation.

Now if we are lucky enough—you probably remember that Grumman has merged now with—we thought they were going to merge with Martin Marietta, but that changed and I think it is Fairchild now, but at any rate, if we are lucky enough to get the contract for the new advanced basic trainer, then that will keep our operation in Chennault until the year 2005, it will be for the manufacture of over 1000 of those trainers. And that is something that we are looking forward to, and that is something that we could not have done if we did not make the effort to get Boeing in in the first place.

Louisiana was one of the engineers of our EPSCOR program and to date has received over $6 million from five federal agencies through nine separate grants. The latest grant is from NASA and is the second NASA grant to be awarded to Louisiana. The Department is a member of the planning committee of the Louisiana Educational Quality Support Fund which recommends to the Board of Regents funding for the various EPSCOR proposals. While we feel that the concern by the federal government for the quality of research in America's universities and colleges is warranted, we also recommend that benchmarks be set so that no institution continues forever in the EPSCOR program. The federal government must also realize that the states are interested in the commercialization within the state of the university applied research. This commer-

cialization within the state is not currently addressed by Congress or the federal agencies.

The Department manages a total quality program for small to medium-sized manufacturers and businesses. And true to our credo of letting industry drive the program development and implementation, the steering committee includes Louisiana members of the American Society of Quality Control, representatives of local quality groups, small business development centers, local professional economic developers and the Advanced Manufacturing Service at Louisiana State University in Shreveport. This group advises the Department on and sponsors Matchmaker Conferences in strategic locations throughout the state.

A look into our future shows us a federally funded modernization or shop floor training program. If we are to assist our manufacturers modernize, they must also have the resources to retrain and upgrade the training of their employees. Now all of us are aware that our larger companies, the Fortune 500 or Fortune 1000, all of those companies are what they call restructuring. It is a euphemism for elimination of a number of long-term employees, many of whom are too young to retire, even early retirement, and they must be retrained and equipped to take other jobs. We have just been informed, for example, that Texaco, who is, by the way, the largest lessee of state-owned lands in Louisiana, that Texaco plans a restructuring which would almost eliminate domestic exploration. This could be quite serious for those people, as I say, from somewhere between 35 and 50 that have had a substantial longevity with the Texaco company, but will soon be unemployed. We have to have training programs for those people to equip them for jobs that will be available in the 21st century. This is probably my highest priority. The idea of two training programs, one is the ad hoc training program, such as we demonstrated in Boeing in Lake Charles where we trained a work force for a specific industry and a specific company. And then there is the other, the general type of training, which we have to do in our schools.

It is unfortunate and I think most states have this problem. It is unfortunate to me that the 80 percent of our kids that do not go to college are left out of the curriculum. Our curriculum in our secondary schools is devoted almost entirely to that 20 percent who do go to college, as a result of which we find that the kids who are in that 80 percent group, that universe, get bored and drop out. And I think that we can cure some of our dropout problems if we were to change our curriculum approach and give an alternative track. This is something I think that the federal government has addressed itself to, the administration has talked about the school-to-work program and I think that they are on the right track.

Finally, I say that our group advises the Department and sponsors matchmaker programs, conferences throughout the state, as I pointed out. A look into our future shows us a federally funded modernization program which I have described.

As I said, Louisiana is new to the modernization effort. For too long we depended upon our natural resources, we depended upon our petrochemical industry and our wood products industries. Those were our largest manufacturers and those are the people that were producing for us. In addition to that, of course, we had

tremendous reliance on agriculture. All of these things have changed and we now must adapt ourselves to the world as it is going to be in the latter part of the 1990s and into the 21st century. We have got to adapt to that.

I think that it was brought home to me quite adequately when I was up in East Carroll Parish, this is one of our poorest parishes in the whole state. We have an unemployment factor up there of over 25 percent and that is not including the people who have left to seek work elsewhere. In asking about it, I said but I do see wealth up here, I see a great deal of wealth because it grows some of the best cotton in the United States. This is true, but they told me, do you know what one automatic cotton picker replaces as far as human beings are concerned? And I said no, I have no idea, I am a city boy, I would not know a cotton picker if I saw one. And they said 300 people. So you can imagine what has happened in this transition and we have to face it.

Finally Mr. Chairman, Mr. Congressman, I would say that I hope that the federal government can form the partnership that we were talking about before. It is so important that we understand that the American industry can go in its direction and we can help. We should not—I resist the idea of a rigid industrial policy whereby a central government would try to direct our resources in one direction or another. The reason I say that is because I think it stifles entrepreneurship and I think it stifles what the marketplace best decides.

Thank you.

[The prepared statement of Mr. Reilly follows:]

WRITTEN STATEMENT

PRESENTED TO THE

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

by
Kevin P. Reilly, Sr.
Secretary
Louisiana Department of Economic Development

July 7, 1994

Congressman Hayes, representatives of Federal agencies here today and the committee staff, I want to welcome you to Louisiana. Although we are relative newcomers to those programs available to States through various Federal agencies and laboratories, I am pleased to share with you the perspective of the State so that we might join with Louisiana manufacturers and our university-based research community so that they may meet the challenges of the marketplace in the 21st Century. I wish your time permitted us to show our successes and demonstrate our needs to you.

We operate the State's economic development programs on the premise that the role of the State should be one of support, not hindrance, and of motivation, not overregulation. We believe in listening to our customers, be they Louisiana business or local governments.

So, in developing new programs, dropping old programs and adjusting current ones, we look for ways that our manufacturing sector can compete more effectively in regional, national and global economies. Government must remember who is doing the competing. It is private industry that is on the firing line. It is private industry that makes this state, this nation one that provides economic opportunities, growth and prosperity for our citizens.

Our role, yours and ours, should be that of agents of change. We must offer the nation's manufacturers, especially small-to-medium sized manufacturers, the opportunity to learn about and to try new technologies, new solutions and new management techniques that could enable them to compete in the 21st Century. Effective state economic development programs are based on an intimate knowledge of the needs of its manufacturers and how state policies affect their competitiveness. There is a vast variance in state policies across the nation. For this very reason, Congress should allow for state and regional flexibility in designing programs. And more importantly, Federal agencies should develop rules in conjunction with the States. This would insure that programs meet the real needs of the nation's manufacturers.

We believe that Congress should take a holistic view of the impediments to competitiveness, consult regularly with the States, and then develop program delivery by two methods -- directly by an appropriate Federal agency or by the States through block grants.

Written Statement
Kevin P. Reilly, Sr.
July 7, 1994

Since time is limited, let me take you on a brief tour of some of the goals we've set forth.

The State has a Memorandum of Understanding with both Stennis Space Center and Marshall Space Flight Center. We have begun the development of one with Johnson Space Flight Center. The Department operates the Louisiana Tech Transfer Office which is housed at Stennis. Since its inception in April of 1992, this Office has served over 1400 clients. The management and staff at Stennis have been more than generous in providing assistance to us.

The Apparel Center for Integrated Manufacturing at the University of Southwestern Louisiana is currently partnering with the Department of Defense, Levi Strauss and Leadtec, Inc. under a Manufacturing Technology Program grant. Work being done by the A-CIM Center and the U. S. Department of Agriculture's lab in New Orleans are part of the reason that the apparel and textiles industries are one of the State's target industries. We currently have employed over 16,000 people in these industries. We also produce nearly a million bales of cotton annually. Our petrochemical industry produces dyes and materials for synthetic fibers. These factors give us the infrastructure to interest both domestic and foreign investors in Louisiana as a site for spinning and weaving operations.

Our aeronautics/aerospace industry employs nearly 4500 Louisianians. Martin Marietta Space Systems in New Orleans partners with us for specialized tech transfer. In addition to Martin Marietta's tanks, Louisiana has firms engaged in avionics, guidance systems, rehabilitation, service and our near future holds the manufacture of experimental aircraft using new designs and new materials.

Louisiana was one of the engineers of the EPSCOR program and, to date, has received $6,000,000 from 5 Federal agencies for 9 grants. The latest grant is from NASA and is the second that NASA has awarded to Louisiana. The Department is a member of the planning committee of the Louisiana Educational Quality Support Fund which recommends to the Board of Regents funding for various EPSCOR proposals. While we feel that the concern by the Federal government for the quality of research in America's universities and colleges is warranted, we also recommend that benchmarks be set so that no institution continues forever in the EPSCOR program. The Federal government must also realize that the States are interested in the commercialization within the state of university applied research. This commercialization within the state is not currently addressed by Congress or Federal agencies.

The Department manages a total quality program for small-to-medium manufacturers and businesses. True to our credo of letting industry drive program development and implementation, the steering committee includes Louisiana members of the American Society of Quality Control, representatives of local quality groups, Small Business Development Centers, local professional economic developers and the Advanced Manufacturing Service at Louisiana State University in Shreveport. This group advises the Department on and sponsors Matchmaker Conferences in strategic locations in the State.

Written Statement
Kevin P. Reilly, Sr.
July 7, 1994

A look into our future shows us a Federally funded modernization or shop floor training program. If we are to assist our manufacturers modernize, they must also have the resources to retrain or upgrade the training of their employees. The establishment of this program would make other modernization programs synergistic. Industry in Carencro, New Iberia or De Ridder can't wait for bureaucracy to respond to today's needs and current training programs do not meet them.

As I said, Louisiana is new to the modernization effort. I hope that our future holds a "thumbs-up" on an application to NIST so that we can complete planning for an industrial extension service. We are already a full partner in a new 15 state consortium to stimulate inter-firm collaboration. USNet is funded by NIST. Once again, Louisiana, in partnership with the Federal government, is in at the beginnings of a new-to-the-United States method of increasing competitiveness.

The State is also working towards a Manufacturing Technology Center to work in conjunction with an industrial extension service.

Louisiana has an exciting present in the apparel/textile and aeronautics/aerospace industries. I think that our future can be exciting, too. However, progress can only be made when government programs are responsive to its customers' needs; progress can only be made when each of us do the things we do best; progress can only be made toward the shared vision of economic opportunities, growth and prosperity when the Federal government, the States, the academic community and industry are equal partners around the problem solving table.

Mr. Chairman, I hope that this hearing is a step toward that equality.

Mr. HAYES. Thank you very much. I appreciate you coming.

I am going to go ahead and let our next panel assemble and use the time that they are assembling to do a few more clean-up items.

A transcript of all of the statements that were provided to us will of course be placed into the record and what I would ask you to do on our subsequent panels is to just summarize those remarks, give us a chance for a few questions back and forth and allow you to place those themes into the record for our remaining panels. You will notice that unlike some Congressional Subcommittees, we do not swear in witnesses. I realize that since we are in Louisiana, it would not do a damned bit of good anyway, so there is no reason to even adhere to that formality. [Laughter.]

Kevin, thanks again for coming.

This panel, for our guests and observers, is a panel designed to show a federal role in the evolution of the partnerships with universities. I do not know if you have a particular order in which the three of you would wish to proceed. It would certainly be fine with me if that were the case. If not, then I will just begin in the sequence from left to right, with Mr. Carr.

STATEMENT OF KEVIN CARR, DEPUTY DIRECTOR, MANUFACTURING EXTENSION PARTNERSHIP PROGRAM, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, GAITHERSBURG, MD

Mr. CARR. Thank you.

Mr. Chairman and Members of the Committee, thank you for inviting me here today to talk about developments relating to technology policy and the programs at the National Institute of Standards and Technology (NIST). I would like to request that my written statement be included for the record.

Let me begin with a broad perspective on the issues. We are seeing a change in the federal R&D investment by the Clinton Administration, which reflects a changing global environment with these key characteristics:

Global competition has accelerated the rate of innovation. On the negative side, this means that we no longer stand out as leaders in several key industrial technologies. On the positive side, however, our competitors' aggressiveness and success have forced us to drive innovation at faster and faster rates. When it comes to technological innovation, it is clear that those who do not speed up will fall behind—and probably by the wayside.

The end of the Cold War means that we have a tremendous opportunity to refine our technology investment strategy—from one based largely on defense and the needs of single-mission federal agencies to an agenda that is geared to the needs of our industries and our work force. The government is responding to these changes by investing more heavily in civilian technology, with a goal of boosting civilian R&D to account for more than 50 percent of the federal government's total R&D portfolio by 1998. Driving defense expenditures toward a dual-use technology base that supports our national security in a broader context, taking into account our economic strength. And putting a greater emphasis on transferring technology from government mission-oriented laboratories into the commercial sector.

At the same time, our overall approach to R&D is changing. We have a clear recognition that being tops in science is not enough. Nor is it enough to be tops in technology-related inventions. We need to be worried most about bringing technology and people together, and moving inventions and innovations into the marketplace—where they can foster strong industries and new jobs.

The Federal government now supports about half of all of the research and development conducted by the United States, but only a relatively small proportion of that support is directly aimed at benefitting U.S. industrial competitiveness. Global technology and market changes are demanding shifts in that Federal R&D mix.

President Clinton has spelled out a clear approach for making those changes, more vigorously supporting civilian technology in our post-Cold War era. Commerce Secretary Brown has helped to guide that strategy, making technology one of the department's top priorities and attracting extraordinary industry involvement and support. That speaks volumes about how both government and industry now jointly view government technology activities.

NIST supports U.S. manufacturing efforts to leverage advanced technology and hone a competitive edge in domestic and foreign markets.

As part of the Commerce Department's Technology Administration, NIST aims to promote U.S. economic growth by working with industry to develop and apply technology, measurements and standards. We do that through four major programs that make up a portfolio of technology-based tools:

A competitive Advanced Technology Program providing cost-shared awards to industry to develop high-risk technologies that can enable significant commercial advances;

A grassroots Manufacturing Extension Partnership helping small- and medium-sized manufacturing companies adopt new technologies;

A strong laboratory effort planned and implemented in cooperation with industry and focused on infrastructural technologies, such as measurements, standards, evaluated data, and test methods; and

A far-reaching quality improvement program associated with the Malcolm Baldrige National Quality Award.

Let me briefly describe each of these programs, then provide some examples of how the Manufacturing Extension Partnership is working with the aerospace and textile/apparel industries.

The NIST laboratory programs have long been recognized for their practical assistance to industry and their focus on infrastructural technologies that support our economy. The benefits from such enabling technologies typically spread across entire industries, and the investments needed to produce them cannot be recovered by individual companies. NIST is the only part of our Nation's technology enterprise that has this measurement mission and capabilities.

Our manufacturing-related programs are designed to respond directly to industrial needs and often involve partnerships with U.S. companies and other government agencies.

Quality goods and services are at the heart of any nation's prospects for success in the global marketplace, and the Malcolm

Baldrige National Quality Award Program has been extraordinarily successful in helping U.S. industry to meet the quality challenge. Well over one million copies of the Malcolm Baldrige National Quality Award criteria have been distributed worldwide—just one indicator of the program's reach in recognizing and promoting improvements in quality management by manufacturers, service companies, and small businesses. The award is having a dramatic effect, making a previously amorphous concept both concrete and achievable for thousands of U.S. companies. That has led to both improved customer satisfaction and profitability for these firms.

The Advanced Technology Program, or ATP, aims to accelerate commercial technology development. The ATP provides cost-shared funding to individual companies and industry-led joint ventures to develop the high-risk, high-payoff technologies that can enable significant commercial progress. The program seeks to build bridges between basic research and product development. It is designed to help companies to better exploit new scientific knowledge that demonstrates technical feasibility and removes technical barriers to commercialization. Just a few years after receiving the first awards in 1991, ATP-funded projects are beginning to yield the technical and business results that promise large payoffs for U.S. companies and our economy.

NIST's Manufacturing Extension Partnership, or MEP, the program which I represent, is a true grassroots effort to improve the competitiveness of the nation's small- and medium-sized manufacturers. There are more than 370,000 small- and medium-sized manufacturers in the U.S. with fewer than 500 employees; they account for about 95 percent of all U.S. manufacturers and are a substantial share of new manufacturing jobs. These companies have a major impact on their local economies—and on our national well-being. But to compete successfully, many of these companies need to upgrade their use of manufacturing technology, and to incorporate world-class manufacturing practices. These smaller firms often do not have the technical resources to identify, to prioritize, and to put in place many of the manufacturing improvements they need in order to survive and thrive. That is where the MEP can make a difference.

The MEP helps these companies to adopt new technologies through manufacturing technology centers, smaller outreach centers, the State Technology Extension Program, and by linking and networking technologies and programs that interconnect MEP participants into a nationwide system. This includes critical links to outreach and technical assistance programs managed by other Federal agencies, including the Departments of Energy and Labor as well as the Environmental Protection Agency, the Small Business Administration, and others. Client firms from the first seven centers have reported $320 million in benefits between 1989 and 1990—a return of seven dollars for each federal dollar invested in these centers. A truly national network can have enormous impact.

The MEP is a merit-based competition, with only the best proposals receiving our funding support. Proposals are evaluated on the proposer's knowledge of target firms in their region, the technology resources that they have, the technology transfer mecha-

nisms that they have for serving those customers, and the management and financial plans of the centers.

Let me give you two specific examples of what MEP has done with the aerospace and apparel companies and some of the impacts that those companies report.

In Kansas, when Boeing told Manufacturing Development, Inc., (MDI) that it needed to meet Boeing's stringent D1–9000 quality standards—or risk losing their business—MDI Vice President Michael Castor knew the company needed help. The 30-person sheet metal fabricator located in Cheney, Kansas, depended on its work with Boeing, its largest customer. The company called the Mid-America Manufacturing Technology Center (MAMTC) for assistance. MAMTC provided MDI employees on-site training in Statistical Process Control, which was required to comply with Boeing's quality standards. The training focused on short-run situations and was coordinated with both in-plant data collection and the development of capability studies for MDI equipment, all of which were required by Boeing. In addition, MAMTC helped MDI secure a state grant that paid for half of the training costs. Through its work with MAMTC, MDI not only received certification by Boeing and retained its largest customer, but it also estimates that it will achieve a 50 percent reduction in scrap, reduce rework by 25 percent, and realize an annual savings of $132,000. In addition, the company has applied for and received certification to become a supplier for other companies, and was honored with the Preferred Supplier Award from McDonnell Douglas, neither of which would have been possible prior to upgrading employee skills and quality practices at MDI.

Future Products Co. of Benson, Minnesota, manufactures fabric products ranging from sports jackets and carpenter aprons to lawn mower bags. The company opened its plant two days after its previous parent company had pulled out of the business. They had to quickly learn the business systems and accounting practices that went along with the manufacturing operations that they already knew. As a result of working with the Upper Midwest Manufacturing Technology Center in Minnesota, the company applied computer technology to upgrade and streamline accounting procedures and linked them to inventory and diversified their product line. In addition to helping implement the technology, the Manufacturing Technology Center in Minnesota linked the company to the Small Business Development Center to gain access to the business systems expertise that was needed to make it happen. The company retained all 100 employees that were slated to be let go when the previous owners pulled out, and expected to do two million dollars in sales in 1993.

As you can see from these examples, NIST is involved in manufacturing issues in a big way. They are a vital part of our mission at NIST in the Department of Commerce, and they are central to others around the Federal government, particularly the Department of Defense. At NIST, we are fully committed to working with our colleagues across the government to make sure that we, collectively, are investing in the most effective manner possible. NIST has a long history of collaboration with other federal agencies. As

we grow into a new NIST that has a wide span of activities, we plan to continue and build on these relationships.

A key factor in successfully scaling up our efforts will be our ability to closely coordinate and leverage our capabilities with other technology-oriented Federal agencies.

We have long-standing relationships with the Departments of Defense and Energy, NASA, and literally dozens of other agencies. In the past year, as other agencies have paid closer attention to how their resources can be brought to bear on our civilian technology base, and as the role of the Commerce Department, the Technology Administration and NIST has been strengthened, these interactions have intensified. We intend to build on this base of cooperation, and to work with other agencies whenever it will help us to fulfill our unique mission of strengthening U.S. industry and the economy through the development and application of technology, measurements and standards.

In building our programs to stimulate civilian technology for economic growth, we are charting a new course for Federal R&D. Two pivotal questions must guide these efforts are, first, how do we set priorities for investing taxpayers' dollars? And second, once the investments are made, how do we assess their impact? The short answer is that NIST's priorities are set and results are measured on the basis of benefits realized by U.S. industry—industry drives our efforts.

Mr. Chairman, this concludes my statement and I will be pleased to answer any questions that you may have.

[The prepared statement of Mr. Carr follows:]

UNITED STATES
DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS
AND TECHNOLOGY

Statement of Kevin Carr
Deputy Director
Manufacturing Extension Partnership
National Institute of Standards and Technology
Before The
Subcommittee on Oversight and Investigations
Committee on Science, Space and Technology
United States House of Representatives

July 7, 1994

Mr. Chairman and Members of the Committee, thank you for inviting me here today to talk about developments relating to technology policy and the programs at the National Institute of Standards and Technology (NIST).

Let me begin with a broad perspective on the issues. The Clinton Administration is changing the way the Federal government invests in R&D. In doing so, the Administration is responding to a changing global environment with these key characteristics:

- Global competition has accelerated the rate of innovation. On the negative side, this means that we no longer stand out as leaders in several key industrial technologies. On the positive side, our competitors' aggressiveness and success have forced us to drive innovation at faster and faster rates. When it comes to technological innovation, it is clear that those who don't speed up will fall behind -- and probably by the wayside.

- The end of the Cold War means that we have a tremendous opportunity to redefine our technology investment strategy -- from one based largely on defense and the needs of single-mission federal agencies to an agenda that is geared to the needs of our industries and our workforce.

How is the government responding to these changes?

First, the Clinton Administration is committed to fostering long-term growth for the economy and high-quality job opportunities for Americans. A very important part of these efforts is to invest more heavily in civilian technology, with a goal of boosting civilian R&D to account for more than 50 percent of the federal government's total R&D portfolio by 1998.

Second, our defense expenditures are being driven toward a dual-use technology base that supports our national security in a broader context -- taking into account our economic strength. The Defense Department's Advanced Research Projects Agency (ARPA) plays a key role here.

Third, there is a greater emphasis on transferring technology from government mission-oriented laboratories, such as the Department of Energy labs, into the commercial sector. Some evidence of this trend is the growing number of cooperative research and development agreements that government laboratories are signing with private-sector partners.

At the same time, our overall approach to R&D is changing. We have a clear recognition that being tops in science is not enough. Nor is it enough to be tops in technology-related inventions. We need to be worried most about bringing technology and people together, and moving inventions and innovations into the marketplace -- where they can foster strong industries and new jobs.

The Federal government now supports about half of all of the research and development conducted by the United States, but only a relatively small proportion of that support is directly aimed at benefitting U.S. industrial competitiveness. Global technology and market changes are demanding shifts in that Federal R&D mix.

President Clinton has spelled out a clear approach for making those changes, more vigorously supporting civilian technology in our post-Cold War era. Commerce Secretary Brown has helped to guide that strategy, making technology one of the department's top priorities and attracting extraordinary industry involvement and support. That speaks volumes about how both government and industry now jointly view government technology activities.

Building on the initiative first provided by Congress -- especially the Committee on Science, Space, and Technology -- NIST is now playing a much more important role in the government's technology strategies. Manufacturing technology is at the core of this vision. We must be able to use technology to revitalize our manufacturing sector, and we must help create an environment in which industry can bring new technology to market and compete effectively.

Manufacturers today face unprecedented demands from their customers, coupled with increasing competition from around the world. Together, these forces are pushing manufacturers to deliver low-cost, high-quality, differentiated -- and even customized -- products. And at the same time, these forces demand that new products be introduced more rapidly and that new, stronger relationships be forged between suppliers and customers

in the manufacturing chain. We are already a long way from the Model T days of "any color you'd like as long as it's black." For the U.S. industrial base to compete globally and continue to provide high-quality jobs to our citizens, one critical element will be the implementation of the technology tools to meet all of these stressing requirements.

NIST supports U.S. manufacturers' efforts to leverage advanced technology and hone a competitive edge in domestic and foreign markets. Over half of our budget is devoted to manufacturing-related activities.

While the NIST component of the Federal R&D budget traditionally has been a very small fraction of the total investment -- less than one percent -- for FY 1995 we have been singled out for the largest percentage growth of any technology agency.

As government increases direct investment in civilian technology, government technology activities still must complement and support -- rather than substitute for -- the private sector's R&D activities. At NIST, we are guided by, and are well positioned to meet, that requirement.

That is because NIST's mission is straightforward -- and unique. As part of the Commerce Department's Technology Administration, NIST aims to promote U.S. economic growth by working with industry to develop and apply technology, measurements and standards. We do that through four major programs that make up a portfolio of technology-based tools:

- A competitive Advanced Technology Program providing cost-shared awards to industry to develop high-risk technologies that can enable significant commercial advances;

- A grassroots Manufacturing Extension Partnership helping small and medium-sized companies to adopt new technologies;

- A strong laboratory effort planned and implemented in cooperation with industry and focused on infrastructural technologies, such as measurements, standards, evaluated data, and test methods; and

- A far-reaching quality improvement program associated with the Malcolm Baldrige National Quality Award.

Let me briefly describe each of these programs, then provide some examples of how the Manufacturing Extension Partnership is working with the aerospace and textile/apparel industries.

Laboratory Programs

The NIST laboratory programs have long been recognized for their practical assistance to industry and their focus on infrastructural technologies that support our economy. The benefits from such enabling technologies typically spread across entire industries, and the investments needed to produce them cannot be recovered by individual companies. But there is pent-up industry demand for NIST research, measurement technologies, and services. While NIST has had several decades of flat or eroding budgets, entire new industries -- biotechnology and computer networking, for example -- have emerged, and the technical needs of established industries also have increased. We need these increases to fill the widening gap in our national measurement infrastructure. NIST is the only part of our Nation's technology enterprise that has this measurement mission and capabilities.

Whether the R&D topic is intelligent machines, intelligent processing of advanced materials, precision machining, or process measurements needed to make the next generation of integrated circuits, NIST's manufacturing-related programs are designed to respond directly to industrial needs and often involve partnerships with U.S. companies and other government agencies.

Often working with industrial collaborators that range from major automotive and aircraft manufacturers to small software firms, NIST is now developing many of the infrastructural elements of 21st century manufacturing. The Information Age equivalents of road signs and maps, these elements include standards, data dictionaries, software tool kits, conformance tests for ensuring the compatibility of hardware and software products, and architectures or frameworks for integrating manufacturing and engineering operations within and across companies.

NIST plays a key role in an industry-focused effort to develop and foster the wide-scale adoption of standardized, computer-readable formats for describing all the useful information about a given product, from initial design specifications to manufacturing processes to customer-support requirements. To advance the development of product data exchange, hundreds of U.S. firms and federal agencies are participating in these voluntary standards-development activities that NIST coordinates.

The benefits of industry-wide adoption of product data exchange are many. For example, rapid, simultaneous information sharing can foster an integrated, team-oriented approach to product design and development. Studies of companies that have developed in-house product data exchange standards indicate that such concurrent engineering methods supported by fully integrated product- and process-information systems yield sizable dividends. Engineering design costs were reduced by 15 to 20 percent and

product-development lead times were cut by 30 to 60 percent. At the manufacturing level, benefits included substantial increases in the productivity of workers and capital equipment. The benefits would include the opportunity to develop integrated chains of suppliers and to develop much closer relationships with customers.

Malcolm Baldrige National Quality Award Program

Quality goods and services are at the heart of any nation's prospects for success in the global marketplace, and the Malcolm Baldrige National Quality Award Program has been extraordinarily successful in helping U.S. industry to meet the quality challenge. Well over 1 million copies of the Malcolm Baldrige National Quality Award criteria have been distributed worldwide -- just one indicator of the program's reach in recognizing and promoting improvements in quality management by manufacturers, service companies, and small businesses. The award is having a dramatic effect, making a previously amorphous concept both concrete and achievable for thousands of U.S. companies. That has led to both improved customer satisfaction and profitability for these firms.

Advanced Technology Program

The Advanced Technology Program, or ATP, aims to accelerate commercial technology development. The ATP provides cost-shared funding to individual companies and industry-led joint ventures to develop the high-risk, high-payoff technologies that can enable significant commercial progress. The program seeks to build bridges between basic research and product development. It is designed to help companies to better exploit new scientific knowledge that demonstrates technical feasibility and removes technical barriers to commercialization. Just a few years after receiving the first awards in 1991, ATP-funded projects are beginning to yield the technical and business results that promise large payoffs for U.S. companies and our economy.

ATP awards aim to accelerate the steps leading to the commercialization of product technologies and-- just as important-- to the application of new and better process technologies. Today, ATP has manufacturing projects under way with a variety of companies and consortia, including Saginaw Machine Tools, the National Center for Manufacturing Sciences, and the Auto Body Consortium. ATP grows in the years to come, it will continue to support significant manufacturing technology efforts.

In FY 1994 the ATP program has doubled, the number of awards expected to be made-- to 120. It also established focused programs in which proposals are sought in specific, well-defined program areas.

Through a series of public meetings with industry, we found widespread support for the idea that focused program competitions can help maximize the ATP's leverage by driving key, strategic technology areas. Between October and December 1993, the U.S. technical community demonstrated this potential by submitting more than 450 ideas for focused ATP program areas.

In FY 1995, we expect the ATP to become a powerful national program that makes a meaningful difference to our industries rather than being just an effective pilot program that has helped a limited number of companies.

Manufacturing Extension Partnership

NIST's Manufacturing Extension Partnership, or MEP, the program which I represent, is a true grassroots effort to improve the competitiveness of small and medium-sized U.S. manufacturers. There are more than 370,000 manufacturers in the United States with fewer than 500 employees; they account for about 95 percent of all U.S. manufacturers and a large share of new manufacturing jobs. These companies have a major impact on their local economies -- and on our national well-being. But to compete successfully, many of these companies need to upgrade their use of manufacturing technology, and to incorporate world-class manufacturing practices. These smaller firms often do not have the technical resources to identify, to prioritize, and to put in place many of the manufacturing improvements they need in order to survive and thrive. That is where the MEP can make a difference.

The MEP helps these companies to adopt new technologies through manufacturing technology centers, smaller manufacturing outreach centers, the State Technology Extension Program, and linking/networking technologies and programs that interconnect MEP participants into a nationwide system. That includes critical links to outreach and technical assistance programs managed by other Federal agencies -- including the Departments of Energy and Labor as well as the Environmental Protection Agency, the Small Business Administration, and others. Client firms of NIST's first seven centers reported $320 million in benefits between 1989 and 1993 -- a return of $7 for each federal dollar invested in the centers. A truly national network can have enormous impact.

The geographic reach of the MEP is expanding significantly in FY 1994 with the establishment of additional extension centers managed by NIST with funding from the Defense Department's Technology Reinvestment Project, led by the Advanced Research Projects Agency.

The MEP is a merit-based competition, with only the best proposals receiving our funding support. Proposals are evaluated on the proposers' knowledge of target firms in the region, technology resources, technology transfer mechanisms, and management and financial plans.

At the FY 1995 request level, combined with TRP funding, the MEP have a total number of Manufacturing Technology Centers under NIST management at about 20, and a total number of Manufacturing Outreach Centers, which are smaller extension centers, under NIST management at about 50. The requested increase will substantially increase the availability of funding through the State Technology Extension Program to states that are starting work to improve or establish manufacturing extension programs. The increase will also enable improved interconnections with other extension services provided through other Federal agencies, and it will further the linking systems needed to form a national MEP network for communications, data sharing, identification of training resources, and intensive evaluation efforts.

Let me give you some specific examples of what MEP has done with aerospace and apparel companies and some of the impacts the companies report. In Michigan, staff at our Midwest Manufacturing Technology Center (MMTC) worked with Aircraft Precision Products, Inc., a manufacturer of seals and parts for jet engines, that wanted to diversify its client base and find ways to reduce costs and improve processes. The MMTC helped the company implement Just-in-Time inventory control, setup-time reduction techniques, and a preventative maintenance program. The results: Aircraft Precision Products reported that they had reduced setup time by 50%, reduced machine tool repair costs by 50%, and reduced work-in-progress inventory by $1 million.

In Kansas, when Boeing told Manufacturing Development, Inc., (MDI) that it needed to meet Boeing's stringent D1-9000 quality standards -- or risk losing their business -- MDI Vice President Michael Castor knew the company needed help. The 30-person sheet metal fabricator located in Cheney, Kansas, depended on its work with Boeing, its largest customer. The company called the Mid-America Manufacturing Technology Center (MAMTC) for assistance. MAMTC provided MDI employees on-site training in Statistical Process Control, which was required to comply with Boeing's quality standards. The training focused on short-run situations and was coordinated with both in-plant data collection and the development of capability studies for MDI equipment, all of which were required by Boeing. In addition, MAMTC helped MDI secure a

state grant that paid for half of the training costs. Through its work with MAMTC, MDI not only received certification by Boeing and retained its largest customer, but it also estimates that it will achieve a 50% reduction in scrap, reduce rework by 25%, and realize an annual savings of $132,000. In addition, the company has applied for and received certification to become a supplier for other companies, and was honored with the Preferred Supplier Award from McDonnell Douglas, neither of which would have been possible prior to upgrading employee skills and quality practices at MDI.

A leader in high temperature composite bushings and bearings, the Tribon Corporation faced an increasing level of offshore and out-of-state competition. Their 1990 revitalization program pivoted on a World Class Manufacturing (WCM) philosophy, including initiation of Statistical Process Control, Work Cells, Manufacturing Resource Planning, and Total Quality Management. With the support of our Great Lakes Manufacturing Technology Center, a division of the Cleveland Advanced Manufacturing Program, Tribon took strategic incremental steps toward their WCM goal. Support included planning meetings, work cells implementation, quality workshops, remedial skills assessments, and telephone courtesy training. As a result of these efforts, Tribon reported a productivity increase of 20% within the first year of the revitalization program. The efforts also produced a significant change in the company's philosophy and culture, as they recognized and moved to offset changes made by their competition.

One of the resources that the Georgia Manufacturing Extension Alliance will be using to assist manufacturers is the Apparel Manufacturing Technology Center, funded by the Dept. of Defense. The Apparel Manufacturing Technology Center has equipment and computer-related technologies for the apparel market, including pattern design marker making, computer-controlled fabric cutting and other technologies. While the apparel center hosts workshops and does some work with companies, it doesn't actively provide one-on-one manufacturing services to companies like the manufacturing extension center does. We expect this will be another good example of the synergy possible as a result of a DoD/DoC partnership.

In Louisiana, in cooperation with the U.S. Department of Labor's Employment and Training Administration, we have begun a pilot project called the Vendors Partners Program and Vendor/Purchaser Network. The project is administered by the Shreveport Chamber of Commerce and is designed to facilitate the development of long-term relationships between area suppliers and major corporations. This goal will be accomplished through information exchange, a certification program to agreed-upon standards, a bid-matching database, and training for vendors and purchasers on joint ventures, partnering and risk sharing.

The Vendor/Purchaser Network will be comprised of the current membership of the North Louisiana Purchasing Network (47 major companies and 44 vendors) and will coordinate the activities of the Vendor Partners Program. Major companies in the Network include: General Electric, General Motors, AT&T, Poulen Weed Eater, Thiokol and GNB Battery. Suppliers (vendors) include Berg, Inc., Netherton Co., and Ark La-Tex Business Forms.

Future Products Co. of Benson, Minnesota, manufactures fabric products ranging from sports jackets and carpenter aprons to lawn mower bags. The company opened its plant two days after the previous parent company pulled out. They had to quickly learn the business systems and accounting practices that went along with the manufacturing operation they already knew. As a result of working with the Upper Midwest Manufacturing Technology Center (UMMTC), the company applied computer technology to upgrade and streamline accounting procedures and linked them to inventory. The company also diversified their product line. In addition to helping implement the technology, the UMMTC linked the company to the Small Business Development Center to gain access to the business systems expertise that was needed to make it happen. The company retained all of the 100 employees let go when the previous owners pulled out, and expected to do $2 million in sales in 1993.

Coordination and Cooperation with Other Agencies

As you can see from these examples, NIST is involved in manufacturing issues in a big way. They are a vital part our mission at NIST in the Department of Commerce, and they are also central to others around the Federal government -- particularly the Department of Defense (DoD). At NIST, we are fully committed to working with our colleagues across the government to make sure that we -- collectively -- are investing in the most effective manner possible. NIST has a long history of collaboration with all other federal agencies. As we grow into a new NIST that has a wide span of activities, we plan to continue and build on these relationships.

A key factor in successfully scaling up all our efforts will be our ability to closely coordinate and leverage our capabilities with other technology-oriented Federal agencies. We have long-standing relationships with the Departments of Defense and Energy, NASA, and literally dozens of other agencies. In the past year, as other agencies have paid closer attention to how their resources can be brought to bear on our civilian technology base, and as the role of the Commerce Department, the Technology Administration and NIST has been strengthened, these interactions have intensified. We intend to build on this base of cooperation, and to work with other agencies whenever it will help us to fulfill our unique mission of strengthening U.S.

industry and the economy through the development and application of technology, measurements and standards.

Delivering Value to U.S. Industry

The President has asked Congress to make a much larger investment in NIST's civilian technology programs. We are confident that we can meet the challenge and help strengthen the U.S. economy. We recognize that our programs must be closely coupled to U.S. industry's goals and priorities -- and we have nearly a century of proven interactions with industry to build upon. We also have had terrific engagement with industry in our newer programs -- the Advanced Technology Program, Manufacturing Extension Partnership, and Malcolm Baldrige National Quality Award program. In each, we are beginning to see real impact.

Setting Priorities and Measuring Results

In building our programs to stimulate civilian technology for economic growth, we are charting a new course for Federal R&D. Two pivotal questions must guide our efforts. First, how do we set priorities for investing taxpayers's dollars? And second, once the investments are made, how do we assess their impact?

The short answer is that NIST's priorities are set and results are measured on the basis of benefits realized by U.S. industry -- industry's needs drive our efforts.

Conclusion

Mr. Chairman, this concludes my statement, I will be pleased to answer any questions that you may have.

Biography for

Kevin M. Carr
Deputy Director
Manufacturing Extension Partnership
National Institute of Standards and Technology

Kevin Carr currently serves as the Deputy Director of the Manufacturing Extension Partnership (MEP) at the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland. The Manufacturing Extension Partnership focuses on the establishment of a national technology assistance deployment infrastructure through the creation of a network of state and local assistance providers. MEP provides match funding through two of its current major programs: Manufacturing Technology Centers (MTC) Program and State Technology Extension Program (STEP). Technology service providers and programs funded by the MEP Program share the mission of working to enhance the competitiveness of small- and medium-sized manufacturing businesses through the adoption of advanced manufacturing technologies and best practices.

Prior to his appointment at NIST, Mr. Carr served as the Head of the Manufacturing Engineering Research Department at the Navy Electronics Manufacturing Productivity Facility (EMPF) in China Lake, California (currently located in Indianapolis, Indiana). At the EMPF, Mr. Carr managed research and development programs in the areas of plated-through-hole and surface-mount electronics assembly technologies. In addition, Mr. Carr was responsible for operation of the EMPF production and demonstration facilities. The EMPF is the Navy's Center of Excellence in electronics assembly.

Prior to his position at the EMPF, Mr. Carr served as the Electronics Coordinator for the Navy's Manufacturing Technology Program (MANTECH) at the Naval Industrial Resources Support Activity in Philadelphia, Pennsylvania. In this capacity, Mr. Carr monitored MANTECH R&D programs funded among various Naval laboratories and defense contractors. In addition, Mr. Carr assisted in the establishment of the Navy's Best Manufacturing Practices Program.

Mr. Carr holds a Bachelor of Science in Electronics Engineering from Widener University in Chester, Pennsylvania and is a candidate for an Executive Master of Science in Technology Management from the University of Maryland.

87-667 O - 95 - 2

Mr. HAYES. I actually only have a couple and they deal with the Manufacturing Extension Partnership. I am interested in knowing two things about it. One is what efforts are made by NIST and how do you do outreach to let participants know the center is there? In other words, you mentioned several examples of them, one in Minnesota, et cetera. What is the means by which those who can utilize the centers find out about its existence? What methods are used to let the community of interest know that they are there?

Mr. CARR. There are a number of activities that take place, from cold phone calls to marketing literature, to advertising. There are a number of group activities that the center will hold such as, forums on ISO–9000, and forums on improving productivity and statistical process control. So centers will have group activities which tend to at least stimulate an interest by the manufacturing companies and help make manufacturers aware of the changes that they need to make, and that tends to bring companies in one-by-one.

Mr. HAYES. What do you envision the size of the network—I know you talked about the first seven centers—what do you envision in what period of time the numbers of centers growing to?

Mr. CARR. The Clinton administration plan is to have in place around 100 centers by 1997 and we seem to be on track for that.

Mr. HAYES. In what manner will parties interested in looking at existing centers and perhaps developing a concept for proposing a center, what would someone in a university setting or business setting do in order to attempt that result?

Mr. CARR. We have a number of programs, State Technology Extension Program, as an example, that provides planning grants to organizations interested in coordinating their state-based infrastructure. It is a first step towards obtaining a center, but not a necessary step. We also have a number of staff in place to work with states. We have a regional manager, as an example, dedicated to this area, who has visited Louisiana. He has participated in a round table, with some of the state colleges and universities to discuss the program, what the opportunities are and what would be needed to compete successfully.

So there are a number of outreach activities. It is our goal to work with all 50 states, so we have a staff in place that can come to your location or you can come to our location.

Mr. HAYES. All right. Thanks very much.

I am going to go on to Mr. Roger Lewis. And I am sorry, let me first back up. I should have introduced Mr. Carr, he is the Deputy Director of the Manufacturing Extension Partnership Program at the National Institute of Standards and Technology.

Mr. Lewis, who is with us today, is the Director of the Office of Technology Utilization for the Department of Energy. Mr. Lewis, thanks, welcome to Lafayette. And as I say, the statement will of course go in the record and I would appreciate very much your remarks and thoughts as it relates here. And once again, thanks for being here and hope you have enjoyed your visit.

STATEMENT OF ROGER LEWIS, DIRECTOR, OFFICE OF TECHNOLOGY UTILIZATION, DEPARTMENT OF ENERGY, WASHINGTON, DC

Mr. LEWIS. It is a pleasure to be here. This is my first time in Lafayette but I think I would like to come back. The University was most impressive.

The Department has a great deal of interaction in the state, as you are aware. We have offices related to the strategic petroleum reserve, we are one of the agencies that participates in the EPSCOR program, we have an energy-related inventions program that provides grants to innovative research proposals, we have had eight grantees in Louisiana, one from Lafayette.

But as I got the sense from your opening remarks, you have identified a missing piece in the equation as well as a change in the dynamic of the federal/public partnership. The missing piece is the university and the change is the fact that 10–15 years ago, the type of partnerships that we are now routinely engaging in would have been viewed as poor government, as favoritism, as a violation of the arms-length relationship. And now what we see as the best way to provide service to people to help generate economic progress is to embrace industries, as we are doing through the AMTEX process, and individual firms who have meritorious ideas in ways that meet fairness of opportunity and avoid conflict of interest, but allow the entrepreneurial spirit to create jobs, to save energy, to protect the environment, provide goods and services.

The Department of Energy has basically four mission areas in research and development. We have an enduring national security mission that is now focused on non-proliferation and dismantlement and nuclear weapon safety. We have an environmental technology mission to clean up our sites, but also to help foster the development of technology that can be used nationally and internationally. We have an enduring energy supply research agenda that is particularly relevant to the oil and gas industry here and in other states. In fact, our oldest laboratory, which used to come from the Bureau of Mines, was founded in 1910, so we are almost reaching our century of service to the nation in that particular program. And we have an enduring support to basic science.

And we have through these four mission areas invested for the nation in 40 some national laboratories and other specialized facilities. We have a cadre of skilled professionals, scientists, engineers, technicians, a physical plant that would take perhaps $100 billion to replace today if we had to. And based upon I guess a bipartisan record of the last 15 years of changing the ground rules, we are increasingly open to partnerships, to bringing industry and universities into our facilities and to be responsive to industry and inventor drives, and we are seeing great things happening.

The Department of Energy was perhaps the last federal agency to get involved in this because our basic enabling legislation was not until 1989. Most other agencies got cooperative research and development agreement and other authorities in 1986. So we had to do catch-up and follow the lead of NIST and Department of Agriculture and other agencies.

This year, the private sector Technology Transfer Society gave the Department of Energy the Morrell Award for organizational

achievement. So I would like to think that we are doing well. We have improved our processes, but doing things faster does not necessarily mean that you get actual results that go out to the marketplace to create jobs and to save energy.

I have got a couple of examples of things where we can demonstrate that what we have developed in support of our primary mission areas is useful to others. And I think, Mr. Chairman, you recognize that when Congress appropriates money we have to use it for the purposes for which they are appropriated and the challenge is to get the additional leveraging. If we use it for other purposes than which it is appropriated, we go to Leavenworth, not Lafayette. [Laughter.]

Mr. LEWIS. One of the basic costs in aerospace and transportation and in a number of other areas is physical testing of machinery, equipment, cars, airplane wings. In the case of a car, a full scale crash test can cost anywhere between $50,000 and $750,000. Multiply that if you talk about an aircraft or even an air wing.

Because of the needs of the national defense mission of the Department, we did a lot of what might be called impact analysis, and we developed a code at the Lawrence Livermore National Laboratory that simulated and predicted the behavior of metals under certain type of stress—crash, things like going through a bunker in Iraq. And we are able now with a great degree of confidence to rapidly figure out what happens to certain types of metals, components, cars, planes, trains on a computer, just as some saw today downstairs in the Center for Integrated Manufacturing. And rather than spending the time and the money to crash a lot of perfectly good things, we can test design changes very rapidly, and the result is that this software is used in the automotive industry, in the aircraft industry. It is saving money, it is saving time. But to me, the most important part is I believe it is saving lives.

Another example of using the technology base that we developed, in providing service to people is something that is on sale at Target. It is called Bio-Barrier. In Hanford, Washington, we have nuclear waste tanks, we have them in other places as well. One of the problems we found was that pesky roots would get in and find a little crack and burrow in the concrete and cause a problem of leakage. So we tried to develop an environmentally friendly solution to that problem, using an EPA-registered herbicide and timed release—you know, it not quite contact, but it is a 50-year type of contact. We did not damage the trees, but basically the stuff does not taste good and so the roots that would go toward this would turn away and find tastier soil. This technology is now being used in cities around sidewalks and around sewer pipes to avoid billions of dollars of replacement cost and extend the useful life.

Now the Department of Energy did not have really the skills of the marketplace to predict these applications. But we had, again thanks to administration policy and the Congress' enabling legislation, the flexibility to hold outreach events, to have an aggressive technology licensing program, to identify market pull and trade opportunities for partnership. It is not for the Department of Energy to come out and say I have got a great solution, do you have a problem that it fits. It is for us to provide additional service to the nation by listening to industries such as the textile industry or in-

dividual entrepreneurs, and if we can help, finding ways to do that. We can help in basically three ways.

If we have a mission then we can use appropriate funds to buy or to cost-share contract and help a company get started. If there is no DOE relevance but we have what might in GM be described as excess capacity, we can accept work in as reimbursable and accept payment for it. And growing, we can plan the early stage, as the Chairman had pointed out, with industry and the universities to form partnerships and get the benefits planned in rather than depend on serendipity. I think the universities offer an essential bridge between the laboratory scientists at DOE programs and some of the folks in industry, because from a DOE perspective, there have been industry-related research centers at universities far longer than DOE laboratories have had interactions. There are cultural differences and I think there is a great opportunity to bring the knowledge and vibrance of the graduate students in to add to what may be perhaps a too-narrow focus on mission areas.

So we think we are doing well, we believe we can do better. And we think that market pull is the way to go and we would like to come back and have the oversight function tell us how you think we are doing.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Lewis follows:]

STATEMENT

OF

ROGER A. LEWIS

DIRECTOR OF TECHNOLOGY UTILIZATION

OFFICE OF THE DEPUTY UNDER SECRETARY FOR TECHNOLOGY PARTNERSHIPS AND ECONOMIC COMPETITIVENESS

U. S. DEPARTMENT OF ENERGY

BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

JULY 7, 1994

INTRODUCTION

Mr. Chairman, Members of the Subcommittee, it is a pleasure to participate in this Field Hearing on behalf of the Department of Energy and to assist your efforts in overseeing federal research and development programs. In your invitation to the Department of Energy to participate in this hearing, entitled "Beating the Competition at Our Own Game: Technology-based Advances in Manufacturing", you indicated that the main focus of the Subcommittee in this hearing is "to explore new technology advances in the textile and aerospace industries" and to "examine how research and federal resources can best be used to promote these industries and enhance their competitive position." The distinguished witnesses from industry are best able to address their industries' new technology advances. I would like to focus the Department of Energy's testimony on the second part, which can be characterized as how to get maximum economic and social benefits for the American people through effective public-private partnerships. In this testimony I will address the Department's approach to technology partnerships, specific activities related to the textile and aerospace industries, and to describe other Departmental activities that reflect the effective use of our research and scientific and technical resources.

DEPARTMENT OF ENERGY APPROACH TO TECHNOLOGY PARTNERSHIPS

The Administration has provided clear guidance and direction in the area of technology policy, starting with the February 22, 1993 technology policy framework, entitled Technology for America's Economic Growth, A New Direction to Build Economic

Strength. In that document the Administration stated that:

> We can promote technology as a catalyst for economic growth by:
>
> - o directly supporting the development, commercialization, and deployment of new technology;
> - o fiscal and regulatory policies that indirectly promote these activities;
> - o investment in education and training; and,
> - o support for critical transportation and communications infrastructures.

The Administration's policy statement also promised that "All federal support for technology development is being reviewed to ensure that research priorities are in line with contemporary needs of industry and to ensure that strategies for working with industry are consistent." The federal government is also more involved in developing multi-agency approaches to technology development, partnerships, and directed more towards achieving national economic objectives. The Environmental Technology Initiative (led by the Environmental Protection Agency), the Technology Reinvestment Project (led by the Advanced Research Projects Agency), the Clean Car Initiative (led by the Department of Commerce), and the Global Climate Change Action Plan are all examples of how various federal agencies are working more closely together to accomplish Administration objectives and to provide faster and more complete access to federal resources for the private sector.

Nearly a year ago, on July 29, 1993, Secretary of Energy Hazel R. O'Leary appeared before the Committee on Science, Space and Technology and unveiled a draft technology transfer Strategic

Plan entitled, Partnerships for Global Competitiveness. This plan built upon the Administration's February 22, 1993 technology policy framework and began to align the Department of Energy's activities to our research and development mission areas. Under this strategic plan the Department has progressed a great deal during the last year. Let me highlight three key points that specifically relate to the Subcommittee's oversight responsibilities.

First, the Department provided a foundation for partnerships in April of this year when it released a Department-wide Strategic Plan, entitled Fueling a Competitive Economy, which addresses five core business areas: Energy Supply, Environmental Technology, Science and Technology, National Security, and Industrial Competitiveness. It also addresses four other critical success factors: Human Resources, Environment, Safety and Health, Business Practices, and Communication and Trust. For the first time the Department has an integrated approach, with specific goals, strategies and success indicators against which our performance can be measured. This strategic plan, and the ongoing process within the Department of Energy to implement it, provides the foundation for optimizing the Department of Energy partnerships with the private sector, State and local governments, the college and university community, and not-for-profit organizations. The Department of Energy, in areas where we have specific research and development projects or have developed--through such projects--core competencies, is eager to

help develop, transfer, and deploy technologies, processes, and products into the economy to enhance economic competitiveness, save energy, protect the environment, help create jobs, and provide products and services that improve the quality of life not only for those living in the United States, but for people overseas who benefit when products and services are exported overseas. The textile and aerospace industries are good examples.

A second area of progress in the past year has been in streamlining our processes and reaching out to small businesses. We have listened carefully to the comments from members of the Committee on Science, Space and Technology, the private sector Council on Competitiveness, our partners, and other interested observers and streamlined our agreements, provided specific additional tools tailored to the needs of small businesses, and participated in exhibitions and trade shows to bring basic information on partnership opportunities with the Department of Energy to private sector organizations that have not been part of our vendor community and know us less well. Our experience with these changes has been very gratifying. We are reaching more small businesses that we had before, and more firms owned by women and minorities as well. The length of time, on average, from a decision to work together to DOE approval of the cooperative project has been cut <u>in half</u>. We are committed to a continuous improvement process and are actively working with other agencies, such as the Department of Commerce, to leverage

their resources and programs, such as the Manufacturing Extension Program, to better provide one-stop service to our partners.

The third area I would like to mention is the creation of the Office of Technology Partnerships and Economic Competitiveness. This new office, which will be headed by a Deputy Under Secretary, was announced by Secretary O'Leary on June 3, 1994. Its purpose is to provide a clear internal and external focal point for partnerships and to be the champion of the Department's Industrial Competitiveness business area. Its objectives are to help implement the Strategic Plan, to more effectively work with other agencies, and to ensure that our responsibilities under large partnerships, such as the Department has with the American Textile industry, are effectively aligned with our other program responsibilities. The Department's Office of Technology Utilization has been moved into this new organization to provide the core staff for an expanded set of functions and responsibilities.

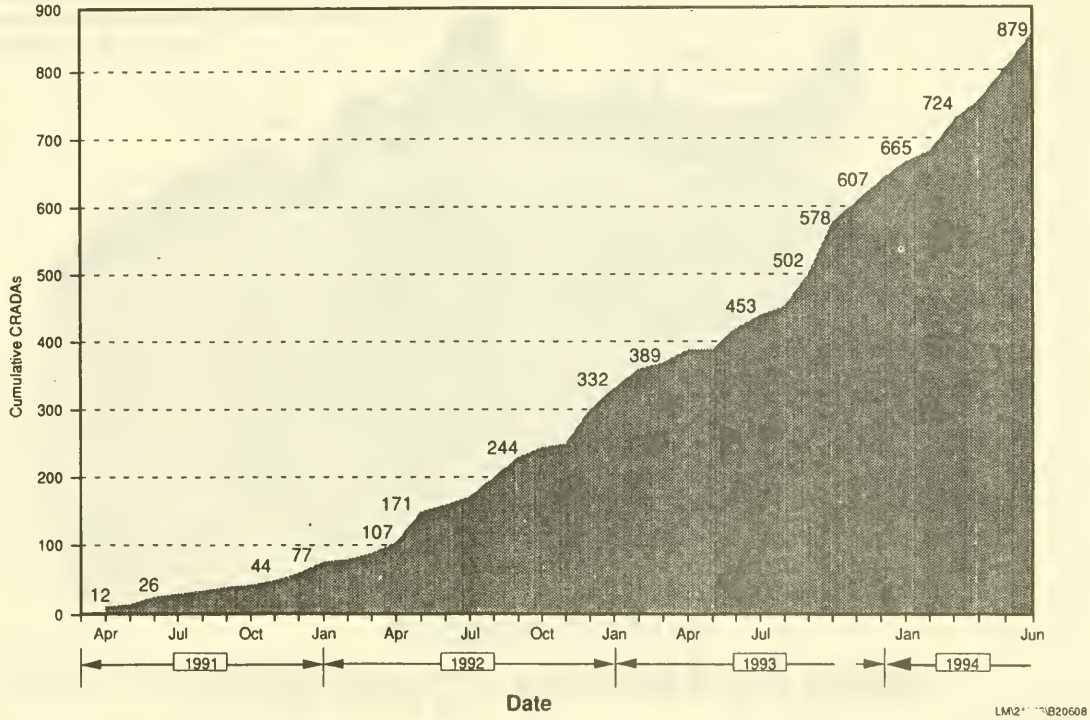
Let me give you, Mr. Chairman, and Members of Subcommittee, a brief overview of the Department's Technology Partnership activities. The Department of Energy has a number of mechanisms that it uses to implement partnerships. These fall into three basic groups. One group includes activities where the Department has a need or primary responsibility, such as acquiring technology through a purchase or publishing information and holding workshops to fulfill information dissemination requirements. A second group includes area where there is no

Departmental program or purpose but work complemtnets our mission activities and can be performed for others on a reimbursable basis. A third, and growing group, is cooperative projects. The most often used mechanism for this is the Cooperative Research and Development Agreement (CRADA). As this testimony was being prepared, the Department of Energy had approximately 900 CRADAs. About two thirds have been approved by the Department of Energy under Secretary O'Leary's leadership. These agreements represent a combined total value when completed of over $1.8 billion. The taxpayers portion of this partnership is about $800 million and our partners contribution is over $1 billion. The attached four charts show the growth in the number of the Department's Cooperative Research and Development Agreements, the number of partners in each state, the technology areas involved, and "repeat business" as an indication that we are a value-added partner. The Department is strongly committed to effective implementation of our technology transfer partnership responsibilities. It is for the Subcommittee and the American people to ultimately judge how effective we have been. I am pleased to note that the Technology Transfer Society recently presented the Department of Energy with the Morrill Award for 1994, its highest award for excellence and innovation in technology transfer.

My purpose in laying out our planning process and several key developments over the past year, and our recent performance information was to provide to the Subcommittee, Mr. Chairman,

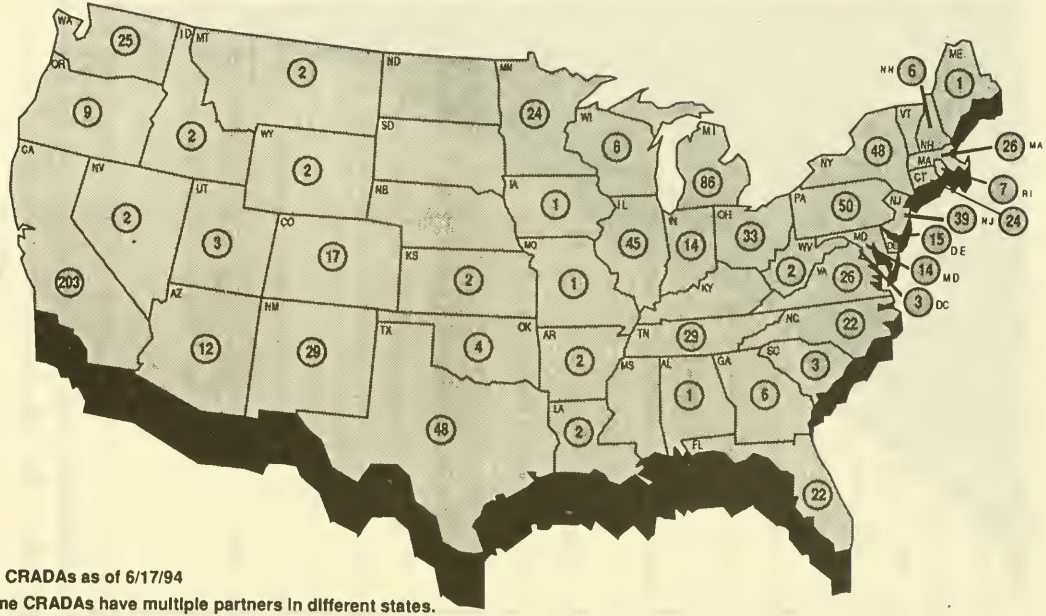
Increasing Number of DOE CRADAs

879 as of 6/17/94



DOE CRADA Partners By State

* 879 CRADAs as of 6/17/94

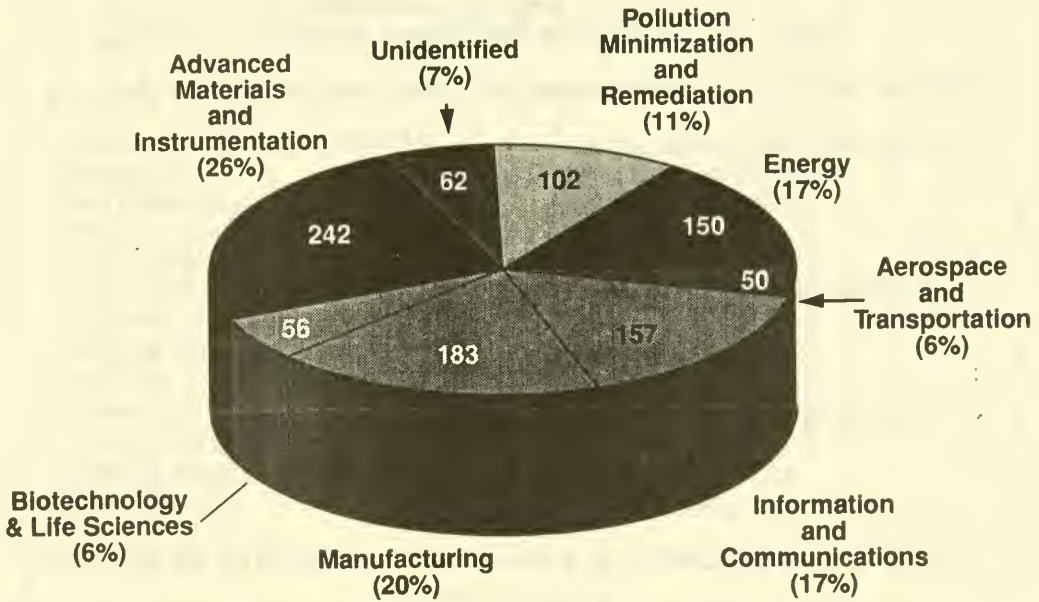


* 879 CRADAs as of 6/17/94
* Some CRADAs have multiple partners in different states.
* There are six partners in Canada.
* Two CRADAs in Alaska

LM21396\F20608

DOE CRADA Distribution by Technology Category*

879 as of 6/17/94



* Some CRADAs count in multiple categories
* Percentages calculated with one category per CRADA

LM21396\D20608

"Repeat Customers" for DOE CRADAs

As of 6/17/94

- **There are 23 participants who have 6 or more CRADAs with DOE:**

Allied Signal (6)
American Textile Partnership (AMTEX) (13)
Amoco (13)
AT&T (10)
California Institute for Energy Efficiency & Sponsors (22)
U.S. Clean Car Initiative (8)
CRAY Research (8)
Cummins Engines (8)
Dow Chemical (8)
Dupont (10)
Electric Power Research Institute (7)
General Electric (10)
General Motors (41)
Hewlett Packard (9)
Institute of Textile Technology (12)
IBM (17)
Motorola (9)
3M (6)
National Center for Manufacturing Sciences (8)
Schlumberger (6)
Texas Instruments (6)
United Technologies (17)
U.S Advanced Battery Consortium (7)

- **There are 74 additional participants who have 2-5 CRADAs with DOE**
- **These 95 participants collectively account for 441 (50%) of the 879 DOE Approved CRADAs.**

LM21398\A20408

with our understanding of the baseline from which effective oversight or investigation should proceed. We have drawn upon clear Administration guidance, which is consistent with our statutory requirements and authorities, gone through an integrated planning process, developed intermediate and long range goals and strategies, and are now implementing the plan.

PARTNERSHIP ACTIVITIES WITH THE TEXTILE INDUSTRY

Let me address now textiles and aerospace and, if I may, also some of the other activities of the Department of Energy relevant to the needs of, and opportunities in, Louisiana and this region.

The Department of Energy has launched a major initiative Under Secretary O'Leary with the American Textile Partnership (AMTEX). Our participation in cooperative research and development activities with the textile industry might seem strange or unexpected to some, since the Department of Energy isn't in the business of growing cotton or other fiber producing plants or making fabrics.

The partnership developed because the Department of Energy has a statutory mission, under the Stevenson-Wydler Technology Innovation Act of 1980 to promote technology transfer and to facilitate private sector access to our facilities, equipment, and staff. During a conference on critical technology, held at the Department of Energy's Lawrence Berkeley Laboratory, a representative of the textile industry discerned that the Department of Energy had significant core competencies that were

relevant to the documented research and development needs of the industry. Here is a case of industry not being interested in what our research projects are, but in the skills and techniques that we use to accomplish them. The textile industry has a need for agile manufacturing. The Department of Energy, unlike most other Federal agencies, has a manufacturing mission--related to the national security programs of the Department. As a consequence we have factories and have had to face the challenge of rapidly shifting production capability, maintaining quality assurance, and keeping pace with technology developments such as rapid prototyping and computer assisted manufacturing.

We had a lot to offer, a manufacturing base, a skilled workforce, significant automation and simulation capabilities. It was clear that it made sense for the textile industry to work with the Department of Energy. We had to ask ourselves, did it make sense, given our limited resources, specific missions, and other responsibilities, for the Department to enter into a large partnership with the textile industry. As I mentioned above, our core business areas include energy supply, environmental technology, and industrial competitiveness. The textile industry is energy intensive. By working together on some of the problems, it is possible that improved processes can result in energy savings--helping the industry and the nation. Large manufacturing activities have an environmental impact. We are working on projects that, if successful, will minimize the

generation of waste or improve recycling ratios and substitute certain materials currently used with more environmentally friendly materials. Other areas of mutual technical interest include computer applications, electronic dissemination of design and manufacturing information, and precision manufacturing. These areas are particularly important to our national security program activities. Thus we can see an alignment between the needs of the textile industry, represented by AMTEX, and the Department's core research and development business areas. In addition, the textile industry has had a rocky experience over the past decade and is striving to regain its national and global market share and therefore this partnership is also well aligned with our industrial competitiveness business area.

As this Field Hearing clearly demonstrates, textiles are important to the State of Louisiana and to the region generally. Louisiana has more than 26,431 jobs in the textile industry, about evenly split between apparel workers and cotton and wool growers. In the last few years, several mills and distribution centers have been built in nearby Mississippi and Arkansas. DOE is working with a large number of textile firms from this region under the AMTEX agreement. The AMTEX partnership has also opened the way for the Department to partner with the universities. The textile industry has a long and distinguished record of successful partnership with Louisiana, including our host today, the University of Southwestern Louisiana. As the AMTEX partnership's research activities with the Department of Energy

continue to evolve we hope that there will be opportunities for expanded participation by universities and other organizations that can assist in the timely and cost-effective accomplishment of specific project objectives.

The AMTEX relationship hold great promise for the future. The Department of Energy already has a proven record of success for the State of Louisiana, the region, and the Nation as a whole.

Aside from AMTEX, the Energy-Related Inventions Program (ERIP) is just one of many examples of efficient, highly effective, and measurably productive Department of Energy partnership programs and activities. This program is based upon statute, the Non-Nuclear Energy Research and Development Act of 1974. To date at least 129 inventions (25 per cent of all the inventions recommended to the Department of Energy by the National Institute of Standards and Technology) have been commercialized. At least $763 million in sales (1992 dollars) have been generated through 1992 by these 129 inventions. There have been at least 36 spin-off companies formed. Firms that commercialized these inventions were also generating over $1 million in 1992 in licensing royalties in addition to their direct sales revenues. At least 668 direct full-time jobs were supported by companies commercializing these inventions in 1992. Secondary employment, by suppliers and others, is also believed to have been generated but is difficult to estimate. At least $2.7 million in federal income taxes in 1992 were paid by

individuals employed in these commercialization activities (this is about 10% more than the ERIP program received from the Treasury in 1992). At least $531 million (1992 dollars) of anticipated energy expenditures were saved by just three of the 129 commercialized technologies. Annual savings are on the order of $100 million. Almost a million metric tons of carbon emissions have been saved by just three of the 129 technologies. The ratio of sales to grants is approximately 20 to 1; the ratio of sales to appropriations (which cover the cost of the technical evaluations, inventor workshops, and program administration) is 8 to 1. Every state but Nevada has had a funded inventor. This program is just one of many in the Department of Energy and in other Federal agencies that are helping the Administration achieve its objectives for the creation of high quality jobs, energy savings, environmental protection, and improved domestic and international economic performance.

There have been several textile-related Energy-Related Inventions Program technologies. These have addressed areas such as:

- Automated processes for garment manufacture
- Computer-aided apparel design system
- Dry process instant photographic color textile printing
- A circular loom for manufacturing tufted carpets.

PARTNERSHIPS ACTIVITIES WITH THE AEROSPACE INDUSTRY

Let me now turn to the aerospace manufacturing area. This

is an area where industry has an interest, like the textile industry, in our core competencies, facilities, and the expertise of our employees, but also where there are more opportunities to align industry needs with the objectives of some of our specific projects. For example, the Department of Energy has a need to model impact or crash effects on weapon systems. A computer simulation developed at the Department of Energy Lawrence Livermore National Laboratory, called DYNA3D, is now used extensively in the auto and aerospace industries. This simulation results in both time savings in design modification and reduced cost by making a number of previously needed physical destruction tests unnecessary. Department of Energy laboratories are also working with the aerospace industry on a variety of collaborative activities, including projects to develop high performance aircraft engine materials and the development of improved fabrication techniques.

The DOE is currently participating with Louisiana State University in a Technology Reinvestment Program project for a regional technology alliance for targeted technology development. There are other manufacturing related Technology Reinvestment Program project involving Louisiana, including a partnership involving the American Rocket Company, Martin Marietta Manned Space Systems of New Orleans, United technologies, and several Air Force laboratories on vehicle technology. The Louisiana Department of Economic Development is participating in USNet, an enabling service for manufacturing networks. Other Louisiana

firms are participating in Technology Reinvestment Program projects directed to manufacturing related to shipbuilding.

Other aerospace/manufacturing related partnerships can be found in the Department's Energy-Related Inventions Program. Inventors from Florida, Texas, Virginia, Missouri, North Carolina and elsewhere have benefitted from technical evaluation by the Department of Energy and the Department of Commerce National Institute of Standards and Technology, workshops providing assistance on business planning and commercialization, and financial assistance to carry their ideas forward. These ideas include:

- improved methods for aluminum corrosion resistance
- strengthened aluminum alloys
- computerized turbine alignment device
- carbon fiber reinforced composites
- dynamic material fatigue measurement method
- improved turbine blade inspection system

EXAMPLES OF OTHER DEPARTMENT OF ENERGY PARTNERSHIP ACTIVITIES

Let me address some other partnership activities that involve the Department of Energy and Louisiana that reflect on our commitment to effective public private partnerships and illustrate for the Subcommittee how Department of Energy research and resources are used to help our partners achieve their economic and competitiveness goals and contribute to the Department's mission accomplishments.

Louisiana has produced at least eight technologies found meritorious by the Energy-Related Inventions Program, including one from Lafayette. The Louisiana developed inventions being supported include:

- o utilization of Oil Waste in manufacture of cement
- o industrial and residential clothes dryer automatic shut-off at dryness
- o high efficiency water heater
- o wet fuel dryer
- o precision herbicide applicator
- o insulated valve coverings
- o self-piloted check valve
- o device for detecting measurement deformities in well components.

Reaching out to industry and others is an important part of our strategic plan. It takes two to tango, or--in the words of noted philosopher Yogi Berra--"If the fans don't want to come to the ballpark, how are you going to stop them?" As you, Mr. Chairman, and the Members of the Subcommittee, well know, the opportunities for public-private partnerships have changed dramatically since the initial passage of the Stevenson-Wydler Technology Innovation Act in 1980. What used to be an arms length relationship between government and industry is becoming an embrace. Just as it has been difficult for many of us in Federal service to keep up with the changing authorities, it has

been even more difficult for many in the private sector, especially small businesses and firms that do not frequently work with government agencies. To address this need, the Department of Energy has an active outreach program, tied wherever possible to parallel activities by other agencies. Our outreach has both a partnership thrust, that brings laboratory technologists to trade shows in the hopes of fostering specific partnership opportunities, and a general educational thrust, that helps conference organizers present basic information on technology transfer, mechanisms, and tailored programs. A recent example of this was the March, 1994 Gas and Oil Technology Transfer Workshop that was held in conjunction with the Louisiana Independent Oil and Gas Association. This group is predominantly made up of small, independent operators. The workshop addressed mechanisms for entering into partnerships with the Department and its laboratories, presented information on environmental research and development activities, and focussed on technologies relevant to issues associated with drilling waste and oil recovery. The Department also participated in this workshop as part of our efforts to support the Lower Mississippi Delta regional initiative.

The Department of Energy's Idaho National Engineering Laboratory and the Exxon Research and Engineering Co. of Baton Rouge, Louisiana had a Cooperative Research and Development Agreement to adapt a spray forming process developed by the Department of Energy to Exxon manufacturing processes. This

enables Exxon to spray a metallic support ring around the circumference on each end of a cordierite ceramic membrane module, replacing steel or ceramic end rings that were used before. The application is in automotive catalysts and more effective methods help in cost control and in environmental performance.

Another Cooperative Research and Development Agreement is between the Department of Energy's Oak Ridge National Laboratory and Monolith Technology, Inc., of New Orleans. The two are collaborating on developing a solidification process for stabilizing waste slurry. A successful method will provide a much more highly-concentrated, energy-efficient and stable waste form, easing the disposal burden. While developed for nuclear related waste, this technology may be applicable to other waste forms.

A key element in long-term public private partnerships involves education. Investment in education and training is a major element in the Administration's technology policy. The Department of Energy works closely with the Department of Education on science education and science literacy programs. The Department of Energy has several national programs that benefit the people of Louisiana as well as the other states. These include:

- o High School Science Student Honors Program

- High School Student Research Apprenticeship Program
- PreFreshman Enrichment Program
- Teacher Research Associates Program

In addition, the Department supports a number of regional programs and partnerships. The Department of Energy's Lawrence Livermore National laboratory is participating with the Louisiana Systemic Initiatives Program (LaSIP) to enhance science education throughout Louisiana. The laboratory conducted five teacher enhancement workshops in science during the summer of 1993. The laboratory has also joined LaSIP as a member of a cooperative partnership involving business, industry, and government agencies to promote continuing support for Louisiana's systemic improvement efforts.

The Department of Energy's Oak Ridge National Laboratory is coordinating the Tennessee Academy for Teachers of Science and Mathematics. This Academy selects teachers from Tennessee, Louisiana and other states and provides a six week program.

The Department of Energy's Strategic Petroleum Reserve, which is well known in Louisiana, supports four programs:

- Partners in Education
- National Science Bowl
- Junior Achievement
- Energy Awareness Poster contest.

The Strategic Petroleum Reserve also provides summer industrial fellowships for teachers and maintains a videotape library that has an active loan program with regional school systems.

The Department of Energy is also aware of the partnership between the Department of Interior National Wetlands Research Center and the University of Southwestern Louisiana to hold a four week Wetlands Research Summer Institute for high school science teachers. The Department of Energy, through the Savannah River Ecology Laboratory and other laboratories and facilities, has significant involvement in wetlands research and monitoring. The Department of Interior's summer institute is designed to bring federal and university scientists together to provide laboratory and field demonstrations for the participating high school teachers.

The Department is investing over $317 million in Louisiana. These investments include DOE procurement of Louisiana products and services, energy conservation grants, fossil and other energy source research and development, education programs, coastal environment protection activities, and the Strategic Petroleum Reserve site management and operation.

CONCLUSION

In conclusion, let me reaffirm the basic principle that the purpose of government is service to people. At the Department of Energy being customer-oriented is our premier core value. We believe that in accomplishing our research and development activities in the core business areas of energy supply,

environmental technology, science and technology, and national security that we have both the opportunity and obligation to foster economic and socially enhancing partnerships. We believe that our specific programs, priorities, and performance can be directly related to the Administration's technology policy priorities as articulated in the February 22, 1993 technology policy framework, Technology for America's Economic Growth, A New Direction to Build Economic Strength, and subsequent policy direction. Through integrated planning and leveraging our research and development investments we can accomplish our goals in the industrial competitiveness business area. I believe that we have a clear statutory and policy framework. The improvements that Secretary O'Leary has facilitated in strategic planning, streamlining our processes, better reaching small business, and organizing for success have positioned us well for both the present and the future. We appreciate that oversight is an essential part of the responsibility of the Congress and can be an effective part of performance measurement and continuous process improvement. I believe that the Department of Energy has demonstrated that it is an effective and value-added partner with industry and others in textile, aerospace and other important regional and national industrial sectors. On behalf of Secretary O'Leary may I again thank you, Mr. Chairman, and the Members of the Subcommittee, for the opportunity to be hear today to assist the Subcommittee in its important work. This concludes my testimony. I would be pleased to answer any questions.

Mr. HAYES. Thank you.

The one thing I would note because the only question I wanted to ask you is about the CRADA partners. With a DOE involvement such as we have, there are 879, I see on the chart in your testimony, there are only two in Louisiana. And what I really want to ask is that our fault or yours and which one can we do better, because an energy state like this—I noticed, you know, Texas had 48, California 203. One or the other or both of us are not involving as many folks as we should. I do not mean that as a criticism of the agency, I mean it as a criticism of the process. How can we improve that process from our end or yours or both?

Mr. LEWIS. We do look at geographic distribution, and we had participated, as the written testimony shows, in an outreach conference with the oil and gas industry which we planned because it related to the lower Mississippi delta initiative, which is an initiative sponsored by Senator Johnston in the Senate, and you know, it is an issue of access and information.

There are some folks out there who still carry, with cause, a distrust of the federal government of the paperwork. We need to overcome that. We need to overcome it not with words but with performance. But, you know, as Yogi Berra said, if people do not want to come to the ball park, how are you going to stop them. [Laughter.]

You know, if we truly believe in market pull, then we can't sort of go in technology push. But we have had an aggressive effort of going to broad-based industry forms, non-traditional audiences, reaching over 350,000 people in the auto parts manufacturing and textile this past year, and we are looking to work with NIST, with EPA to basically double-team on technology transfer events in various regions, so that we at least can do our part of providing the basic information.

Mr. HAYES. We will provide you with and follow up—this city alternates with Odessa, Texas in holding a Louisiana/Gulf Coast Oil Exposition that is an enormous trade show, and in effect brings a whole lot of folks, not only directly with their displays and technology development, it has turned into a technology transfer show in the last few years. And I would be delighted to assist in DOE doing something during the time of that show because the audience would be a perfect target audience for some improvement I think in disseminating that information.

Thanks, Mr. Lewis, for coming. I appreciate your comments, and I look forward to working with you on that because I really believe that it is our deficiency as much or more than yours and we are going to do better on our part. Then if you do not do better on your part, then we can fuss at you. But I think we need to make those initiatives first.

Dr. Marsh, thanks also to you. Dr. Marsh is with the National Science Foundation. He is the Deputy Assistant Director for Engineering. The National Science Foundation's authorization is done through my Committee on Science, Space and Technology and therefore I have probably more direct information about part of its workings than most other members of Congress would, and I would like to point out that in the past five years, I would say, the involvement between the University of Southwest Louisiana and

NSF in its grants applications review has grown dramatically and I think that is excellent testimony to Dr. Authement and to the University and to the manner in which they have improved tremendously the kinds of applications detail and delineation to which they did them. I know less about your engineering field and look forward to your testimony, and thanks again for coming.

STATEMENT OF DR. ELBERT MARSH, DEPUTY ASSISTANT DIRECTOR FOR ENGINEERING, NATIONAL SCIENCE FOUNDATION, ARLINGTON, VA

Dr. MARSH. Thank you, Mr. Chairman.

I represent the Engineering Directorate at the National Science Foundation. That is one of six directorates that is responsible for supporting basic research around the country in colleges and universities. I appreciate the opportunity to be here at the University, I had not visited here before and I have been truly impressed by what I have seen this morning at the A–CIM Center. It certainly is consistent with excellence I have seen in other universities around the country in the areas of automation technology.

I was curious before I came down yesterday morning about to what extent the University did participate in existing NSF programs, and I looked at our database and was able to quickly pull up a couple or three pages of information. What I have got here is a list of about 32 active research grants. These are research grants not including the EPSCOR award to the University, but these are across-the-board in science and engineering at the National Science Foundation. I have not added up the figures, but my guess is that this would translate into roughly one to two million dollars. These are grants, that range from fairly most sized grants of $7,000 to one that is in the $200,000 a year range. So the University is an active player in basic research and we would love to see that grow here.

You asked to hear what is going on at the Foundation in a number of areas in manufacturing, technology transfer and in particular the textiles industry and the aerospace industry. Let me give you a little bit of background first on who we are at NSF.

Our mission is essentially to nurture the basic science and engineering research base at the college and university infrastructure around the country. We have been doing this for a little over 40 years, since the early 1950s, and the way that we have traditionally functioned is to support what could be described as curiosity-based research that comes in sort of a bottom-up approach. We take ideas from the research community, evaluate these proposals on their merits and, based on those evaluations, make awards for research.

That has been the traditional approach. What you will see in more recent times, in the last five to ten years, is a continuation of that, but that is also being supplemented by the Foundation's looking at more strategic research themes, themes that have more direct impact on the nation's economic competitiveness, if you will.

Currently we have eight strategic themes of research in place. Let me read you the list. They are in the testimony, but currently these include advanced manufacturing technology, advanced materials and processing, biotechnology, civil infrastructure systems

which is being focused currently in the Engineering Directorate, where I am but we are expanding that to other areas within the Foundation, global change, environmental research, high performance computing and communications and then there is a science, math engineering and technology education initiative as well.

The manufacturing activity at the Foundation currently is funded at about $100 million. This initiative evolved out of the old FCCSET process, which has transformed in a sense to the National Science and Technology Council process. The NSTC has been in place since December of last year, and it is a committee our council that was established by the President and is indeed chaired by him. The NSTC intent is to essentially set the country's agenda in science and technology research.

Currently the manufacturing initiative at the National Science Foundation comprises four basic goals including research for advanced manufacturing technology, the transfer of new knowledge emanating from this research to the industrial user community, support of the human resources manufacturing base by education and training programs and promotion of environmentally conscious manufacturing. We implement this manufacturing activity in a variety of mechanisms. These include individual and multiple investigator awards to academic institutions, center awards to academic institutions, and small business innovation research awards.

I should point out that not only do we have outreach to the university community, but also outreach to the small business community, so we have a small business innovation research approach which is duplicated in a number of other federal agencies, I might say.

There is also the small business technology transfer award idea. This is similar to the SBIR idea, but it is one that insists upon an academic participation as well.

We have engineering education coalitions, which are funded within our—within the engineering directorate. The intent there is to work at the issue of systemic change in the way we teach engineering. Engineers are usually taught the basic sciences and if you are lucky enough to hold onto an undergraduate student through his senior year, they might get to the point where they are doing a senior project that might have some industrial relevance. We would like to have engineering students develop that taste for industrial relevance, early on in the education process and one of the things we are trying to achieve in the education coalitions is the exposure of undergraduate students early on, say in the freshman year, to what engineering is really all about and what the real needs are. That is we would like to get them involved in some design, and some manufacturing activities as freshmen. And these coalitions are set up to do that. We have eight of them in place, each of them comprises about six to ten institutions.

Let me get back to the manufacturing research of the Foundation. Notable among the center awards are the engineering research center grants, the industry/university cooperative research center grants, and then we have another version of that which is the state/industry/university cooperative research center grant. The second of these is essentially one that involves universities interacting directly with industry. So it is a three-way partnership be-

tween the federal government, the university and industry. The third option is one where the state government is also involved. This option is relatively new and has been in place for about four years and I think we have 12 or 13 of these state/industry/university cooperative research centers currently in place.

We have 18 engineering research centers and 11 of these have manufacturing relevance and over 20 of the 55 or so industry/university cooperative research centers and state/industry/university cooperative research centers have manufacturing relevance.

Let me tell you a little bit more about some of these entities. The ERC or engineering research centers program was started in 1985. The goal was to bring engineering and scientific disciplines together in major research and education centers in areas where fundamental engineering advances would enhance American industrial competitiveness. Each ERC is established as a three-way partnership involving academia, industry and the National Science Foundation. And in some cases there is participation of state and local and/or federal government agencies—other federal government agencies. Annual funding for the centers ranges from $2.5 million to $8 million. NSF's contribution is $1.8 million to $3.3 million a year on average. Leveraging is about two-to-one in the ERCs. The objective of this program is to bring engineering and scientific disciplines together to address fundamental issues crucial to the next generation of technological advances from an engineering systems perspective. The program also aims to educate a new generation of engineering students in cross-disciplinary team approaches to problem solving and the program requires active participation and long-term commitments from industry and other user organizations.

The IUCRCs, or industry/university cooperative research centers on the other hand conduct research that is of interest to both industry and academia. But the IUCRC is typically supported at a much lower level by the National Science Foundation than an ERC. An IUCRC often begins with a small planning grant to a university professor who seems to exhibit the scientific, organizational and entrepreneurial skills necessary to start and run a successful center. If it is successful in its planning grant, it receives an operating grant of five years or so at a level of about $50,000 per year which is renewable. And when the five-year grant expires, the seed funding ceases. The centers at this point in time are required to be self-sufficient for the future. At present, more than half of the IUCRCs are self-sufficient. The contribution here is fairly small, as I mentioned, the total NSF investment in the IUCRC program is only about $4 million, but this is leveraged at about a ten-to-one level. Currently funding from other sources other than NSF is about $60 million, and that was in fiscal year 1992. I believe that has increased to some extent since then.

I have also alluded to the SBIR solicitation. The primary objective of this program is to increase the incentive and opportunity for small firms to undertake cutting edge, high risk, high quality scientific engineering or science education research that would have a high potential for economic payoff if the research is successful. The SBIR concept comprises three-phases of activity, the first being a six month feasibility study, the second being the principal research effort to ascertain commercial viability, the third and final

phase is conducted with non-federal funds to pursue commercial applications of the research.

The STTR program is in place to stimulate the transfer of technology from research institutions to the marketplace through cooperative research. STTR involves small companies in exploiting a new reservoir of commercially promising ideas which originate in universities and other non-profit research institutions. STTR requires researchers at the university to play a significant role in each STTR program. This is a fairly new undertaking. Currently we only have $1.4 million invested in STTR at the National Science Foundation. I expect that this is going to grow.

On the other hand, the SBIR program is fairly substantial in size. At NSF, it comprises $42 million of the 1995 budget. By Congressional legislation, we are required to provide 2 percent of our so-called extra-mural research funds for SBIR, and I believe that figure will grow to about two and a half percent by 1997.

So that is a quick summary of our manufacturing research, its intent and how we implement it through a variety of mechanisms.

You also asked us to comment on technology transfer and I would like to address that as well. The U.S. has traditionally depended on knowledge transfer mechanisms based on informal discovery, publication, inquiry or discovery patent licensing cycles. However, any advantage that U.S. companies have derived from their proximity to the nation's research infrastructure has been eliminated or reversed as our competitors have become increasingly adept at deriving benefit from the nation's extant knowledge transfer process. NSF has long recognized that the problem has interrelated sociological, economic, educational and technological dimensions and has been active in experimenting with new approaches. And some of these approaches are described a little bit later on in my testimony.

NSF sponsored centers provide excellent opportunities for academic/industrial partnership and technology transfer. There are approximately 25 industry/university centers that focus on various aspects of design, manufacturing that are supported by the NSF. They are industry focused with strong industry presence and support and include, as I have mentioned earlier, the engineering research centers, the science and technology centers which are not focused in the engineering area but are more broad-based and cover all of the science areas that the Foundation supports. There are materials research science and engineering centers, industry/university cooperative research centers and the state version thereof. The ERCs have over 400 different industrial members. The agile manufacturing initiative which is jointly funded by us and ARPA and is fairly new, involves 14 universities and 100 companies. In addition, the NSF super-computer centers have very close links with industry and make the most advanced software and hardware for super-computers available to manufacturing industry to solve practical problems.

We have a number of new entities that we have brought on line in recent times to enhance this transfer potential at the Foundation. There is a new initiative called the GOALI program that refers to Grant Opportunities for Academic Liaison with Industry. This is an initiative that is being shared between the Engineering

Directorate and the Math and Physical Sciences Directorate, with the hope and expectation that we can extend this across the Foundation in the future. This program provides for engineering faculty, and scientists as well, internships, combined research industrial scholarship projects and industry/university cooperative research projects. So this is a real solid opportunity for researchers to spend some time away from their own labs, and in industry.

I recall there has been some mention of the Baldrige Award. The NSF is currently sponsoring research on understanding the basic ideas behind quality. This is an initiative that is about $8 million. We are cost-sharing this with industry. Industry is providing about six of the eight million dollars, as where the Foundation is providing the other two. And we have an initiative that is called the Transition to Quality Organizations initiative.

We have several other partnerships, I have alluded to some of them here, I will not go into great detail on those. We have one that links us with the Electric Power Research Institute in Palo Alto in California. This is an excellent mechanism that allows us to link university researchers directly with the electric power research industry. We also have a fairly recent Memorandum of Understanding that we have signed with the National Institute of Standards and Technology and we are looking at mechanisms for implementing that.

Let me just quickly allude to a couple of specifics. I know I have probably exceeded my time here, but I did want to get some information on the record about textiles-related research. Currently we are supporting a couple of industry/university cooperative research centers that look at textiles-related research. One is at the North Carolina State University and is called the Non-Wovens Cooperative Research Center and it is one of the state IUCRCs. The state of North Carolina is participating in supporting that center. There is also the Webb Handling Research Center at the Oklahoma State University nearby in Stillwell, Oklahoma.

In the areas of aerospace-related research, one of our 18 ERCs is at Mississippi State University nearby. It is the Computational Field Simulation center. It addresses essentially issues in computational fluid dynamics, research that could have an impact in the aerospace area as well. And there are mechanisms for linking with these centers. I should mention that and if the university is interested in doing that, it should touch base with the centers people at the Foundation to see how that is done, what the procedures are.

I have also alluded to agile manufacturing. We have an agile manufacturing initiative that is jointly shared with ARPA. Let me define what agile manufacturing is. It is—this is a quote from Mr. Goldman—"the ability to thrive in a competitive environment of continuous and unanticipated change to respond quickly to rapidly changing markets driven by consumer-based evaluating of products and services." And I think if we can make some headway here we will really increase the country's industrial competitive stand. We are working this together with ARPA in two different types of entities; one is the agile manufacturing forum which is established at Lehigh University in Pennsylvania and it is their objective to define what agile means. I have given you this basic definition here,

but we need to translate that into some usable concepts and the agile manufacturing research institutes' intent is to take those concepts and implement them in the research environment. We have three of these institutes and there is one nearby here at the University of Texas at Arlington under Dr. John Mills, and it is focusing on aerospace manufacturing. So you might want to touch base with the people there to see how this university might fit into that activity.

I know I have exceeded my time. There is a lot more I could discuss here with regard to this. We feel that linking our university people more closely with industry is very, very important and you are going to see a good deal more of that in the future. I will finish on that note.

[The prepared statement of Dr. Marsh follows:]

TESTIMONY OF
DR. ELBERT MARSH
DEPUTY ASSISTANT DIRECTOR FOR ENGINEERING
NATIONAL SCIENCE FOUNDATION

BEFORE THE
SUBCOMMITTEE ON INVESTIGATION AND OVERSIGHT
OF THE HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

JULY 7, 1994

Thank you for the opportunity to address you today. I am Elbert Marsh. Deputy Assistant Director for the Engineering Directorate at the National Science Foundation (NSF), a federal agency which sponsors cutting edge research in engineering, science and education. The environment in which we at NSF plan our research and education agenda is an active one and has been impacted substantially by developments in both the Executive and Legislative branche of government. On the Executive side. recent establishment of the National Science and Technology Council (NSTC) has revised the way the country's research and development policies evolve. The NSTC comprises nine committees whose functions are to assess the country's research and development needs. Currently, NSF supports eight major initiatives in Advanced Manufacturing Technology, Advanced Materials and Processing, Biotechnology, Civil Infrastructure Systems, Global Change, Environmental Research, High Performance Computing and Communications, and Science - Math - Engineering and Technology Education. Plans for each of these topics are being developed and will be adjusted periodically based on analyses of changing national needs and priorities as guided by NSTC. On the Legislative side, the recent Government Performance and Review Act (GPRA) has explicitly directed the Foundation to formalize its planning process and to establish mechanisms for evaluating and assessing its research and education programs.

I understand that the interest here is Technology Based Advances in Manufacturing, and that the focus of today's hearing is to explore new technology advances in the textile and aerospace industries, and how research and federal resources can best be used to promote these industries, thereby enhancing their competitive positions. I also understand that you also are interested in the general area of technology transfer to the user community. Although NSF's support of both textiles and aerospace research is somewhat limited, NSF's interest in and support of more general manufacturing and technology transfer issues is strong and growing. I'd like to apprise you of current NSF efforts in manufacturing, industry-academic-government partnerships, and technology transfer of new knowledge to industry. I will also comment on specific NSF sponsored research activity related to textiles and aerospace technology.

I. MANUFACTURING RESEARCH

Currently, the National Science Foundation supports manufacturing research through a variety of mechanisms, including individual and multiple investigator awards to academic institutions, center awards to academic institutions, Small Business Innovation Research (SBIR) awards and Small Business Technology Transfer (STTR) awards to the small business sector, and Engineering Education Coalitions Notable among the center awards are the Engineering Research Centers (ERC) grants, Industry University Cooperative Research Center (IUCRC) grants and State Industry University Cooperative Research Center grants. Of the eighteen ERCs in existence, eleven have manufacturing relevance, whereas approximately 20 of the more than fifty five IUCRCs and State IUCRCs are manufacturing relevant. Before discussing NSF manufacturing research, it is probably informative to describe more fully the ERC, IUCRC, SBIR, and STTR, entities alluded to above.

In 1985, the National Science Foundation's Directorate for Engineering established the Engineering Research Centers Program in accordance with a model envisioned by the National Academy of Engineering. The goal of the ERC Program is to bring engineering and scientific disciplines together in major research and education centers in areas where fundamental engineering advances will enhance American industrial competitiveness. Each ERC is established as a three-way partnership involving academia, industry, and the National Science Foundation (in some cases with the participation of state, local, and/or other Federal government agencies). Annual funding for a Center ranges from $2.5 to $8.0 million, with the NSF's contribution ranging from $1.8 to $3.3 million per year. The objective of the program is to bring engineering and scientific disciplines together to address fundamental research issues crucial to the next generation of technological advances from an engineering systems perspective. The program also aims to educate a new generation of engineering students in a cross-disciplinary team approach to problem solving. The program requires active participation and long-term commitments from industry and other user organizations.

The IUCRCs also conduct research that is of interest to both industry and academia, but the IUCRC is typically supported at much lower levels than an ERC. An IUCRC often begins with a small planning grant to a university professor who seems to exhibit the scientific, organizational, and entrepreneurial skills necessary to start and run a successful Center. If the prospective Center can obtain commitments of strong support from industry and the affiliate university, it receives an "operating grant" for five years of support from NSF, at a level of approximately $50,000 per year, renewable annually. When the five-year grant expires, NSF seed funding ceases. Centers at this stage are required to be self-supporting, or self-sufficient, by means of industrial and other funds. At present, more than half of the IUCRCs are self sufficient. NSF's financial contribution to the Centers is relatively small--about $4.1 million in FY93. Funding from sources other than NSF is much larger, totaling more than $60 million in FY92. Currently, the Centers have more than 700 members. Of these, about 90 percent are industrial firms, with the remaining 10 percent including State governments, National Laboratories, and other Federal agencies. Most universities also provide direct and/or indirect support (e.g., cost sharing) for their Centers.

NSF invites small business firms to submit research proposals under the SBIR solicitation. The primary objective of this program is to increase the incentive and opportunity for small firms to undertake cutting-edge, high-risk, high-quality, scientific, engineering, or science education research that would have a high potential for economic payoff if the research is successful. The SBIR program is a three-phase process with the first being a six-month feasibility project and the second phase being the principle research effort to ascertain commercial viability. The third phase is conducted with non-federal funds to pursue commercial applications of the research funded in the first and second phases. The SBIR program funding in fiscal year (FY) 94 and FY95 is $31.2 million and $42.3 million respectively, reflecting a congressionally mandated funding level of 2.0% of NSF extramural research in FY95.

The objective of the STTR Program is to stimulate the transfer of technology from research institutions to the marketplace through cooperative research. STTR involves small companies in exploiting a new reservoir of commercially promising ideas which originate in universities and other non profit research institutions. STTR requires researchers at universities to play a significant role in each STTR project. The STTR program funding in FY94 and FY95 is $1.4 million and $2.4 million respectively, reflecting a congressionally mandated funding level of 0.10% of NSF extramural research in FY95.

NSF's manufacturing thrusts address a broad set of goals comprising (1) research for advanced manufacturing technology, (2) transfer of new knowledge emanating from this research to the industrial user community, (3) support of the human resources manufacturing base by education and training programs, and (4) promotion of environmentally conscious manufacturing. The advanced manufacturing technology and environmentally conscious manufacturing goals can be further subdivided into four major research goals including (A) development of technology supporting the next generation manufacturing systems and integrated manufacturing cells; (B) evolution of new technology for development of integrated tools for product, process, and enterprise design; (C) filling the gaps in the manufacturing knowledge base in support of the national manufacturing infrastructure; and (D) developing new technologies for environmentally conscious design and manufacturing.

Next generation manufacturing systems will rely on electronic commerce and flexible business and management structures for rapidly reconfigurable, highly automated, integrated production systems. As exemplified by the concept of "agile manufacturing," such systems will improve the flexibility and concurrence of all facets of the production process and integrate differing units of production within a firm and among firms through integrated software and communications systems. In realizing goal A (above) of developing new technology to support implementation of next generation manufacturing systems and integrated manufacturing cells, the following three objectives must be met:

Objective 1: Define the business, organizational and technical issues critical to the implementation of agile manufacturing.

Objective 2: Define the strategies, protocols and interface standards that are needed to seamlessly link design and production facilities at differing locations.

Objective 3: Enable the participation of US university-based researchers in the international Intelligent Manufacturing Systems (IMS) Initiative.

Integrated tools for product, process, and enterprise design allow for the simultaneous evaluation of the impact of changes in product design, manufacturing, delivery and servicing. They are the outcomes of research in rapid and concurrent design. An integrated set of engineering tools will provide the base for next generation manufacturing enterprises. The emphasis is on developing an integrated framework, operating environment, common data bases, and interface standards for a wide range of emerging tools and techniques for designing manufacturing processes, equipment, and enterprises. In realizing goal B (above) of developing tools for product, process and enterprise design, the following three objectives must be met:

Objective 1: Achieve the transparent integration of software tools for computer-aided design, process simulation, factory scheduling, product pricing, and life-cycle costs, including warranty costs and environmental impact.

Objective 2: Develop integrated software tools to facilitate concurrent product and process design and develop advanced computer and information technologies that support distributed design.

Objective 3: Development of integrated software tools for the simulation, modeling and control of manufacturing processes and systems.

NSF is targeting research that explores issues in materials processing and manufacturing, innovative manufacturing machines and equipment, molecular-scale manufacturing, computer-assisted manufacturing, risk analysis, decision making under uncertainty, total quality management and performance, technology diffusion and implementation, organizational structure and behavior, group decision making and information sharing, the dynamics of customer and supplier interactions, and improved understanding of international performance benchmarks. These efforts are intended to address goal C (above) of filling the gaps in the manufacturing knowledge base, and in realizing this goal, the following three objectives must be met:

Objective 1: Achieve the fundamental breakthroughs in sensors, process modeling, computation and control, and in their coordinated application, to achieve "intelligent manufacturing."

Objective 2: Develop novel processes and machines, particularly for composites processing.

Objective 3: Achieve the fundamental breakthroughs in our understanding of global economics, technology management and diffusion that are required for the development of effective tools for the support of effective technology implementation.

Environmentally conscious design and manufacturing is deemed to be of sufficient importance to warrant treatment as a major goal. The environmental emphasis of the manufacturing initiative is on the development of resource and energy efficient design methodologies and production processes, minimization of the waste stream, and/or the utilization of recycled material or waste as feedstock for subsequent processes. The environmental goal has a strong interface to the NSF Environmental Research Initiative, which emphasizes the design of environmentally benign materials and new methodologies for synthesizing them. In realizing goal D (above) of developing new technologies for environmentally conscious design and manufacturing, the following three objectives must be met:

Objective 1: Develop resource and energy efficient production processes.

Objective 2: Develop software-based design methodologies for design for disassembly and recyclability, life cycle design/assessment and material life cycle analyses.

Objective 3: Monitor progress in the Environmental Research Initiative, to ensure that process development is proceeding on the most environmentally promising materials, using the best synthesis routes.

The second major manufacturing goal involves the transfer of new knowledge emanating from this research in manufacturing technology to the industrial user community. In order to Develop effective mechanisms for transferring relevant knowledge among universities, industry, national laboratories and other government agencies and for acquiring useful knowledge from foreign sources, the following objectives must be met:

Objective 1: Establish working relationships at the research project level between academia, industry, and other potential users.

Objective 2: Transition basic research results to the marketplace by supporting exploratory research to prove the technical feasibility of ideas.

Objective 3: Benchmark foreign technology and provide results in a timely fashion to US researchers in universities and in industry.

The third major manufacturing goal to support the human resources manufacturing base with education and training programs can be achieved through pursuit of a multi-agency product design and manufacturing education and training agenda to produce world-class practitioners. The effort should focus on a systematic program to revitalize US engineering education and training through the introduction of a unifying framework of design and manufacturing integration. This goal can only be implemented in partnership with industry and requires strong support and participation from industry. Strong ties between 4-year degree granting institutions and local community colleges are also needed. Objectives suggested for meeting this goal are:

Objective 1: Develop integrated, manufacturing-oriented engineering curricula that cut across the traditional engineering, science, social science and management disciplines.

Objective 2: Involve industry-based manufacturing experts in classrooms to do both curriculum development and teaching.

Objective 3: Enable community colleges to partner with 4-year colleges, universities, and industry to create educational and training programs to produce the skilled technical workforce that is needed to help construct and maintain next generation manufacturing systems.

II. INDUSTRY-ACADEMIC-GOVERNMENT PARTNERSHIPS AND TECHNOLOGY TRANSFER

The US has traditionally depended on knowledge transfer mechanisms based on informal discovery-publication-inquiry or discovery-patent-licensing cycles. However, any advantage that US companies have derived from their proximity to the nation's research infrastructure has been eliminated or reversed as our competitors have become increasingly adept at deriving benefit from the nation's extant knowledge transfer process the NSF has long recognized that the problem has interrelated sociological, economic, educational and technological dimensions and has been active in experimenting with new approaches. *Thus, new mechanisms must be developed to speed the transition of advanced technology from research laboratories to US-led industrial production through person-to-person interaction.* NSF has an intimate tie to the academic community through a long history of research support to develop the intellectual knowledge base in manufacturing. It realizes the importance of delivering these research results to industry, the ultimate user of fundamental manufacturing research and the employer of skilled graduates in this discipline, and is developing and refining mechanisms to insure that this transfer is efficiently accomplished. NSF has encouraged academe to embrace industry as a valuable resource for manufacturing research and education, and the strategy of establishing partnerships with industry, and other entities is the fundamental approach to achieving more effective technology desired transfer. A number of transfer and partnership mechanisms are described below.

NSF sponsored centers provide excellent opportunities for academic industrial partnership and technology transfer. Approximately 25 industry-university centers that focus on various aspects of design and manufacturing are supported by the NSF. They are industry-focused, with strong industry presence and support, and include Engineering Research Centers, Science and Technology Centers, Materials Research Science and Engineering Centers, Industry/University Cooperative Research Centers and State Industry/University Cooperative Research Centers. The ERCs alone have over 400 different industrial members. The Agile Manufacturing Initiative, jointly funded by NSF and ARPA with additional support from other agencies, involves 14 universities and over 100 companies. In addition, the NSF Supercomputer Centers have very close links with industry and make the most advanced software and hardware for supercomputers available to manufacturing industry to solve practical problems.

The GOALI (Grants Opportunities for Academic Liaison with Industry) Program provides for Engineering Faculty Internships, Combined-Research-Industrial Scholarship Projects and Industry-University Cooperative Research Projects. These programs provide for industry cost-shared faculty/student residences in industry on projects that are jointly defined, submitted, funded and executed by industry-university teams. The GOALI program is therefore an effective way of linking researchers with their counterparts in industry and accomplishing technology transfer.

The NSF also sponsors programs in the social, economic and management sciences which foster research partnerships between universities and the private sector. The Transformations to Quality Organizations Program is a joint industry/NSF program to advance research in organizational quality that is leveraged by NSF and predominantly financed by the private sector The Industry leadership is being provided by the Total Quality Leadership Steering Committee, an organization with representation from most of the leading companies in the US The Management of Technology Innovation (MOTI) Program seeks to develop "practical tools" to improve companies' means for deriving economic benefit from technological progress. Project teams must include co-investigators from schools of engineering and business and an industrial partner, which will provide the organization on which the research will be conducted.

Another partnership example is the one linking the NSF and the Electric Power Research Institute (EPRI) in Palo Alto, CA. EPRI is a not for profit organization supported by the US electric power industry. A memorandum of understanding between the two entities was established nearly ten years ago, and provides for joint sponsorship of research in a variety of topics including polymeric materials, electrochemical reactions, microwave induced chemical reactions, intelligent control systems, and power systems. This is an opportunity not only for leveraging NSF's research resources, but also for direct transfer of research results to the US power systems industry.

Still another class of partnership with technology transfer potential is the growing interaction between NSF and the National Institute of Standards and Technology (NIST). A memorandum of understanding between NIST and NSF was signed in 1993 and called initially for coordinated activity in the areas of chemical science and engineering, high performance computing and communications, manufacturing technology, and materials research. Plans are being developed for implementation of the memorandum of understanding. Some currently anticipated approaches include opportunities for NSF grantees and their students to have access to NIST laboratories, for jointly sponsored workshops, and for participation of academics in Advanced Technology Projects (ATP) sponsored by NIST. Given that NSF's outreach is primarily to academe and that NIST's outreach is primarily to industry, this government agency interaction provides an excellent opportunity to more closely link the academic and industrial sectors Knowledge transfer in both directions is anticipated.

III. NSF RESEARCH IN TEXTILES AND AEROSPACE ENGINEERING

III-1. TEXTILES RELATED RESEARCH

The North Carolina State University Nonwovens Cooperative Research Center is a State IUCRC which was established in 1991. It comprises a government (state and federal)- academic-industry partnership, with fifteen industrial firms supporting the center with matching funds. Nonwovens are a class of textile fabrics which are bonded fiberwebs and which are not woven, knitted or have paper structures Nonwoven products range from very lightweight and inexpensive fabrics used as coverstocks in sanitary products to very heavy weight products such as geotextiles. The nonwovens industry is relatively young and the world leadership position of the United States technology and production is increasingly challenged by Japan and European countries. the primary mission of the Center is to conduct fundamental and applied research on nonwovens product and processing technologies in support of industry needs. The research program includes three thrust areas: (1) material performance, (2) process development and analysis, and (3) materials application and development. Fifteen industrial companies participate in the Center and an Industrial Advisory Board provides review and guidance to the research and technology transfer programs.

The Web Handling Research Center (WHRC) is an IUCRC at the Oklahoma State University in Stillwater OK. The term web is used to describe materials that are manufactured and processed in a continuous-strip form. Web materials cover a broad spectrum from extremely thin plastics to paper, textiles, metals, and composites. Web processing extends to almost every industry today and allows manufacturers to mass-produce a variety of products from materials that originate as a continuous strip of materials. The widespread use of web processing results from the ease and cost-effectiveness of manufacturing and handling materials in continuous-strip form instead of sheets, the need to automate many manufacturing processes, and the need to increase product quality. Web handling refers to the physical mechanics related to the transport and control of continuous-strip materials (webs) through processes and machines. A primary goal of web handling is to transport the material without incurring defects and losses. The mission of the WHRC--the only organization of its type in the world--is to advance the knowledge base in technologies applicable to the transport and control of continuous-strip materials. Primary activities include fundamental and generic research, as well as knowledge and information transfer to and from its industrial sponsors and to small-to medium-sized manufacturing firms in the Oklahoma region.

III-2. AEROSPACE RELATED RESEARCH

The Computational Field Simulation Center, an ERC at the Mississippi State University, was established to address issues in Computational Fluid Dynamics (CFD), a topic of key interest to aerospace engineering, both with respect to airflow over aircraft wing surfaces and to rocket motor dynamics. CFD methods today can simulate flows about complex geometries with simple physics, or about simple geometries with more complex physics. They cannot do both. This Center's mission is to do both--not only for CFD but for real-world field problems in general. Field problems are those in which some physical phenomenon occurs in a two- or three-dimensional space in a complex way. Such problems occur in a broad spectrum of engineering applications: oil exploration; aircraft, ship, automobile, and engine design; thermodynamic,

nuclear, and chemical processing systems: electromagnetic field applications, and others. US industry risks being surpassed by foreign competitors that place strong emphasis on the computing power needed for field simulations. Impressive capability in this field is evident in Europe and Japan, particularly in aircraft, shipbuilding, and automobile industries. The Computational Field Simulation Center's mission is to provide US industry with the capability for computational simulation of large scale, geometrically complex physical field problems for engineering design and application. The research program embodies an integrated approach to computational and computer engineering, and comprises research projects in six thrust areas including solution algorithms, grid generation, scientific visualization, system software, computer architecture and rapid prototyping

The Foundation is engaged in a joint effort with the Advanced Research Projects Administration (ARPA) to support research in agile manufacturing. Agility is defined as "the ability to thrive in a competitive environment of continuous and unanticipated change, to respond quickly to rapidly changing markets driven by customer based valuing of products and services". [1] The objective of Agile Manufacturing is to improve flexibility and concurrence in all facets of the manufacturing process and to integrate differing units of production across one or more firms through common software and communications systems. Agile manufacturing represents a major shift in the way most companies do business, with the potential for firms to combine across corporate and geographic boundaries to design and produce together. In FY 1993, NSF, together with ARPA, established an Agile Manufacturing Institute (AMI) comprising an Industry Forum for Agile Manufacturing (IFAM), and a set of three Agile Manufacturing Research Institutes (AMRI). Both the IFAM and the AMRIs are organized by a university or not-for-profit institute, but are led by advisory boards comprising industrial and academic manufacturing communities. An oversight board, made up of leaders from industry, academe, and government, guides AMI activities and regularly assess progress The forum focuses on strategic analysis, business process and technology requirements, recommendations for pilot programs, and industry training and awareness. The institutes initially focus on three industries; i.e., machine tools, aerospace and electronics. They are engaged in fundamental research; quantitative analysis; fundamental prototyping/proof of concept test beds; education, training, and dissemination; and team building. The University of Texas at Arlington was selected in a recent competition to lead the AMRI on aerospace manufacturing. This institute, under direction of principal investigator Dr. John Mills, comprises an academic-industrial team and will perform implementation experiments with agile manufacturing technologies with specific and strategic emphasis on the aerospace industry. It is developing a strategic understanding of the new modes of organization, production, workforce capabilities, alternative production and communication technologies in the aerospace industry.

Reference

1 S.L. Goldman, "Agile Manufacturing: A New Paradigm for Society," White paper published by the Agile Manufacturing Enterprise Forum, the Iacocca Institute, Lehigh University, PA, undated.

Mr. HAYES. Thank you very much. My questions were going to be about North Carolina and Oklahoma and how they were established but I think you answered that in the course of your testimony.

I am going to go ahead and prepare for our next panel. I am going to take about a ten-minute break.

[Recess.]

Mr. HAYES. We will get back together. I know some of you have flights and other activities and I will make sure that we can stay on line.

We are particularly pleased on our next panel to have representatives of two industries that are so important to southwest Louisiana. What was Grumman and is now Northrop/Grumman, with a facility in Lake Charles, Louisiana, is a good example of sometimes unfortunate events becoming very fortuitous events. When the Chennault facility was converted from an active Air Force Base, it was one of a few, and therefore one that through efforts which you heard Mr. Reilly talk about earlier from the state of Louisiana, expanded and created a vo-tech twinning of industry and creating an employee to work in that industry.

Because of that, when Boeing and its mission statement altered a bit, the facility was again vacant but that was fortuitous in the sense that it had already put a product on line and in place and allowed a Grumman to step in with a project for refurbishing of aircraft and turning it into, by the way, the most sophisticated piece of electronics in aviation history, and placed it in Lake Charles, Louisiana. Today, across the country, you have got hundreds of military facilities that are being closed and no more than dozens of opportunities to put manufacturing on those sites, and virtually none being in a position of having an outstanding training facility already in existence and employees. Boeing will tell you that and I am going to give Grumman an opportunity to tell you that with our next panel.

And since I said that, I guess I had better go to Mr. Van Weele first. He is the General Manager of Northrop/Grumman Corporation in Lake Charles and he will be the first of our three panelists, two of whom, as I say, represent corporate entities with a strong presence here. And then, Mr. Moore is from the American Textile Manufacturers Institute and he will talk a bit about the partnership here at the University.

So with that, Mr. Van Weele, thank you very much for coming over from Lake Charles and I look forward to your testimony as well.

STATEMENT OF ALLAN VAN WEELE, GENERAL MANAGER, NORTHROP/GRUMMAN CORP., LAKE CHARLES, LA

Mr. VAN WEELE. Thank you, Congressman Hayes. I appreciate being invited to today's activities and I look forward to discussing the issues with you. I submitted detailed written testimony for the record and I will summarize my testimony very briefly and respond to any questions you may have.

Manufacturing technology in this country is changing in very fundamental and very dramatic ways. First, the traditional view of defense manufacturing and defense technology as separate and

unique segments of our economy has changed as we have recognized the important contribution that the defense industry, especially the aerospace industry, can make to the economic health of our nation. Second, manufacturing companies have recognized the importance of teamwork between different disciplines and different departments and are moving forward towards a system of integrated product teams and concurrent processes.

In my prepared remarks, I have identified the types of technologies which affect our operations in Lake Charles:

First, defense technologies which are crucial to our future national security. These technologies will directly affect the products which we will build in Lake Charles, such as the Joint STARS radar surveillance aircraft and the Joint Primary Aircraft Training System (JPATS).

"Spin-On" technologies which apply commercial products and processes to defense use. At the Lake Charles facility, we are very familiar with the benefits of commercial practices as applied to military programs. Last year, 73 of our workers received individual awards in the FAA's Aviation Technicians Award Program and our facility was the recipient of the FAA's Diamond Awards for Excellence.

"Spin-Off" technologies will convert our defense technologies into civilian uses.

And finally, "dual-use" technologies which can be used or applied to both commercial and military markets. Northrop Grumman has developed commercial dual-use technologies in areas of manufacturing, biomedical, and transportation.

Perhaps the most important element is the fact that we view these technologies as trends in our local area. In the traditional model for manufacturing industries such as aerospace, R&D was viewed as a distinct function which was disconnected from the manufacturing process. These views were fundamentally flawed because it required a hand-off from the laboratory to the factory. Unfortunately, as those of us who follow professional football on Sundays, fumbles do exist. Historically, the tradition of handing off a product from the laboratory to the manufacturing facility has caused products and technologies to lose market.

At Northrop Grumman we do not believe in the traditional sequential view of a product cycle. Given the severe limitations on R&D budgets in the United States and the fierce competition we face in the global market, we simply cannot afford to fumble. We believe that research, development, testing, and production are parts of a single process which succeeds or fails in the performance of the end product. We believe in a single team—an integrated product team—that is focused on productivity and innovation from the very first day. We consider our customers, both DOD and commercial, as an integral part of this team.

Northrop Grumman employed the Integrated Product Development Team approach with great success in our Commercial Aircraft division and now on the B–2 and Joint STARS Programs. The Joint STARS Program is an excellent example of teamwork between government and industry to develop a high tech system using both military and civilian specifications. During the early stages of the program a decision was made to use FAA require-

ments for the modification of the Boeing 707 aircraft. This decision was the genesis of the world class Northrop Grumman modification facility in Lake Charles. The effort required to remanufacture the 707 into a system which is scheduled to be in service well into the next century is not high tech by itself, but the process that has been developed will provide for the renewal of many other large transport aircraft. We are proving that an airframe can be disassembled, inspected, repaired and modified and then reassembled, using new materials and processes. This process will become the standard by which we preserve and enhance the current fleet of military transport aircraft. It will also provide the FAA with aging aircraft data for our civilian aircraft that will be used to enhance the safety of our airline industry.

At this time, I would like to focus on one small area to demonstrate how a team approach can produce outstanding results in a way that not only will prove that technology can be multiplied—in this case, the technology of paint removal from aircraft. We are using a teaming approach that joins Northrop Grumman and an agricultural company, ADM-Ogilvie, and an electronics company, Canadian Aerospace Electronics, to develop a new paint stripping process.

I might point out that one chemical that has used almost universally in the stripping of paint from aerostructures is methylene chloride. This chemical is very efficient in removing aerospace finishes, but is an ozone depleting substance which must be handled and controlled to preclude any possible environmental impact. Our in-house research has led us on many paths to find a replacement. One that has emerged as the most promising is a blasting technique using wheat starch. This material is biodegradable and user friendly. Our laboratory data has shown that this process is viable. Currently we are using a prototype system to strip paint from the JSTARS aircraft. This system is only the forerunner to a large computer controlled manual paint removal system that will use sensor technology to grade and blend the wheat starch so that an optimized paint stripping rate can be achieved. Once this phase of the program is in place and provides the predicted performance, the next step will be to develop a robotic capability that will minimize the amount of manual work. The equipment will use the same media blending process, but a robot that has learned the size and shape of the aircraft will actually do the paint removal, thus increasing our productivity.

Automation of the paint stripping process will result in another advanced technology—the inspection of the basic aerostructure. We can leverage our manufacturing technology by placing sensors on the robot to inspect the aircraft for corrosion and structural defects such as cracks in fastener holes. We have already conducted preliminary tests to demonstrate that the detection of defects is possible. These sensors will review the structure for defects while the paint removal process is taking place. By combining and automating the paint stripping and inspection processes, we will be able to bring down the cost of remanufacturing an aircraft and improve the safety of the product.

In summary, Congressman Hayes, we are using the integrated team approach to make ourselves industry leaders in productivity

and business. We see manufacturing technology and the manufacturing facilities as integrated parts of the technology process. This is an exciting challenge for us as employees of Northrop Grumman and as citizens of Louisiana. I believe that we will be very successful.

I look forward to any questions you might have. Thank you.

[The prepared statement of Mr. Van Weele follows:]

TECHNOLOGY-BASED ADVANCES IN MANUFACTURING

Testimony for Congressional Hearing
7 July 1994

Alan Van Weele
Northrop Grumman Corporation

Manufacturing technology in the United States is changing in very fundamental and very dramatic ways. First, the traditional view of Defense manufacturing and Defense technology as separate and unique segments of our economy has changed as we have recognized the important contribution the Defense industry, especially the aerospace industry, can make to the economic health of our nation. Second, manufacturing companies have recognized the importance of teamwork between different disciplines and different departments and are moving rapidly toward a system of integrated product teams and concurrent processes

There are four types of technologies which will affect our operations:

- Defense technologies which are crucial to our future National Security. These technologies will directly affect the products which we will build in Lake Charles, such as the Joint STARS and the Joint Primary Aircraft Trainer (JPATS).
- "Spin-On" technologies which apply commercial products and processes to Defense uses. These will become increasingly important as we benefit from acquisition reforms which increase the ability of DoD and the prime contractors to use commercial products and processes in Defense systems.
- "Spin-Off" technologies which convert Defense technologies to civilian uses.
- "Dual-Use" technologies which can be applied to both commercial and military markets. Northrop Grumman has been very active in programs which "spin-off " our proven technologies into commercial and dual-use applications in manufacturing, biomedical, and ground transportation technologies.

In manufacturing technologies, Northrop Grumman is an industry leader in composites and in data systems for manufacturing. In advanced composites processes and materials, Northrop Grumman has developed leading edge technologies in preforming, molding, curing, and materials. These technologies have broad applications in the Defense, commercial aircraft, and automotive industries. Northrop Grumman is participating in a Technology Reinvestment Project (TRP) team to advise the Composites Technology Center on technology status and technology transfer. Northrop Grumman is also participating in TRP programs to develop advanced laser precision machining techniques and to apply neural networks to Just In Time maintenance of manufacturing equipment. Northrop Grumman is participating with UCLA, USC, and other educational institutions in TRP programs to provide integrated manufacturing engineering training at both the graduate and undergraduate levels.

In biomedical technologies, Northrop Grumman is a leader in imaging, remote sensing, information networks, integrated environments, and smart structures. Northrop Grumman has developed technologies which permit the use of filmless cameras for mammography.

In surface transportation, Northrop Grumman is developing wireless communications and automotive sensor systems, Intelligent Vehicle Highway Systems (IVHS) and high-speed ground transportation systems such as Maglev. Northrop Grumman is working with the Advanced Research Projects Agency (ARPA) to develop alternate fueled vehicles for fleet applications.

These major technology trends will have significant implications for us in Lake Charles. Perhaps the most important implication is the fact that we view these technology trends as local issues at all. In the traditional model for manufacturing industries such as aerospace, R&D was viewed as a distinct function which was disconnected from the manufacturing process. That view was fundamentally flawed because it required a hand-off from the laboratory to the factory. Unfortunately, as those of us who follow professional football are well aware, hand-offs can lead to fumbles. Historically, the transition from design to production has led to fumbles...missed opportunities which delayed or prevented the delivery of new technologies and products to the market.

At Northrop Grumman we don't believe that the traditional sequential view of the product cycle is acceptable. Given the severe limitations on R&D budgets in the United States and the fierce competition we face from global competitors, we simply cannot afford to fumble. We believe that research,

development, testing, and production are parts of a single process which succeeds or fails in the performance of the end product. We believe in a single team - an Integrated Product Development Team - that is focused on productivity and innovation from the very first day. We consider our customers, both DOD and commercial, an integral part of that team.

Northrop Grumman has employed the Integrated Product Development Team approach with great success in our Commercial Aircraft division and on the B-2 and Joint STARS Programs. The Joint STARS Program is an excellent example of teamwork between Government and industry to develop a high tech system using both military and civilian specifications. During the early stages of the program a decision was made to use FAA requirements for the modification of the Boeing 707 aircraft. This decision was the genesis of the world class Northrop Grumman modification facility in Lake Charles.

The effort required to remanufacture the 707 into a system which is scheduled to be in service well into the next century is not high tech by itself, but the process that has been developed will provide for the renewal of many other large transport aircraft. We are proving that an airframe can be disassembled, inspected, repaired and modified and then reassembled, not with old materials and processes, but using state of the art materials and finish techniques. This process will become the standard by which we preserve and enhance the current fleet of military transport aircraft. It will also provide the FAA with aging aircraft data for our civilian aircraft that will be used to enhance the safety of our airline industry.

At this time, I would like to focus on one small area to demonstrate how the team approach can produce outstanding results in a way that might not have been possible using traditional approaches to technology...in this case, the technology of paint removal from aircraft.

One chemical that has been used almost universally in the stripping of paint from aerostructures is methylene chloride. This chemical is very effective in removing aerospace finishes, but it is an ozone-depleting substance which must be handled in a controlled environment to preclude any possible environmental impact.

Our in-house research has led us on many paths to find a replacement. One that has emerged as the most promising is a blasting technique using wheat starch. This material is biodegradable and user friendly. Our laboratory data has shown that this process is viable. Currently we are using a prototype

manual system to strip paint from the JSTARS aircraft. This system is only the forerunner to a large computer controlled manual paint removal system that will use sensor technology to grade and blend the wheat starch blasting media so that an optimized paint stripping rate can be achieved. Once this phase of the program is in place and provides the predicted performance, the next step will be to develop a robotic capability that will minimize the amount of manual work. The equipment will use the same media blending process, but a robot that has learned the size and shape of the aircraft will actually do the paint removal, thus increasing our productivity.

Automation of the paint stripping process will result in another advanced technology... the inspection of the basic aerostructure. We can leverage our manufacturing technology by placing sensors on the robot to inspect the aircraft for corrosion and structural defects such as cracks in fastener holes. We have already conducted preliminary tests to demonstrate that the detection of defects is possible. These sensors will review the structure for defects while the paint removal process is taking place. By combining and automating the paint stripping and inspection processes, we will be able to bring down the cost of remanufacturing an aircraft and improve the safety of the product.

In summary, we are using the integrated team approach to make ourselves industry leaders in the productivity business. We see manufacturing technology and the manufacturing facilities as integral parts of the technology process. This is an exciting challenge to us as employees of Northrop Grumman and as citizens of this community. I believe that we will be very successful.

Mr. HAYES. Thank you.

I hope we have an opportunity on some future occasion to do a hearing relating just to the technology, both of the refurbishing of aging aircraft, because this is far beyond an importance that is in merely the 707 refurbishing. The United States, for example, has over 200 B–52s that flew in the Persian Gulf War that are not in service now. The fact that we do not have a next generation of bomber on line has a far more impact in defense than most casual readers could begin to imagine. We are in an interim period in which keeping aging aircraft in the air has an absolutely strategic necessity to maintaining our defense posture.

Likewise in commercial aviation, with cost competitiveness, the longer we can safely fly means a great deal of bottom line and omission of red ink for commercial manufacturers—rather commercial users. These technologies are interchanged only when, once again, you have the partnership of industry in the role of government; in this instance, a defense contractor.

I hope we have an occasion also at some future time to show people more about the JSTAR program. It is an example of a very old aircraft with an unbelievably new interior. And it is concepts in electronics and it is concepts in the reality of the evolution of electronics that only the first brush of which could be seen at the time of the Persian Gulf War. You can sit in that aircraft and look at individual trucks and their movement and identify what kind of vehicles they are. I can assure you it played an enormous role in the success of the Persian Gulf War.

Allan, thank you again for coming. As I say, I hope I have an opportunity in the future, and we are going to make an opportunity to be able to talk more about specifically what you are doing, both in the form of technology and its importance and commercial application for the private aircraft industry as well.

John, I will go to you next. I will comment that since I am from south Louisiana, we of course have no people with hard to pronounce last names. So I am going to guess that it is Wi-god-sky, and I hope that is correct.

Mr. WIGODSKY. That is a very good guess.

Mr. HAYES. Thank you very much. He is the Executive Vice President of Operations for Fruit of the Loom from Bowling Green, Kentucky. John, thank you very much for being here with us.

STATEMENT OF JOHN WIGODSKY, EXECUTIVE VICE PRESIDENT—OPERATIONS, FRUIT OF THE LOOM, BOWLING GREEN, KY

Mr. WIGODSKY. Thank you, Congressman Hayes. I am very pleased to be a part of this forum and to have the opportunity to promote competitiveness in the American textile and apparel industry.

Founded in 1926, Fruit of the Loom is one of the leading textile and apparel companies in the world. Fruit of the Loom had sales of $1.8 billion in 1993 and employs over 34,000 workers in more than 50 locations worldwide. However, 85 percent of our production is generated by our 30,000 domestic workers at facilities in the U.S. And I might add that there are 7,000 employees here in the state of Louisiana.

Fruit of the Loom is a vertically integrated company, performing every process of production, from yarn-spinning to the sewing of apparel. We are the largest consumer of cotton grown in the U.S., using more than 800,000 bales of cotton every year. With four of the largest autocoro spinning operations in the world, we spin over 4 billion miles of yarn a year. Fruit of the Loom workers sew in excess of one billion garments a year, averaging 151 garments per second.

In order to maintain our leadership position, Fruit of the Loom has invested over $1 billion in new plants and equipment in the past six years. We have also created over 20,000 new jobs in the U.S. during that same time period.

However, Fruit of the Loom is extremely concerned about the impact of the General Agreement on Tariffs and Trade, or GATT, and the threat it poses to the American textile and apparel industry. Two million American jobs, located mostly in the southeastern part of the U.S., are at tremendous risk because of this trade agreement.

The GATT agreement phases out textile and apparel duties and tariffs that have historically protected American jobs from low-wage competitors in foreign markets. It will allow large numbers of foreign made products to enter the U.S. market at lower prices, but U.S. manufacturers will not have equal access to large markets in developing countries such as India and Pakistan. For the American textile and apparel industry, it is a lose/lose situation.

Fruit of the Loom is committed to its U.S. manufacturing base, but must continually look for ways to remain competitive, especially in light of U.S. competitors moving jobs offshore.

Fruit of the Loom has strengthened its competitive edge by increasing efficiencies and enhancing the quality of our products. A substantial part of our investment in technology is being made here in the southeast:

As I said, Fruit of the Loom employs over 7,000 workers at five facilities here in Louisiana. We announced last year an investment of $50 million for a new, state-of-the-art manufacturing and distribution center, currently under construction in Vidalia.

In Texas, we have created more than 2,000 jobs since 1990 for American workers in Harlingen and Raymondville.

Rabun Gap, Georgia is home to Fruit of the Loom's largest facility with over one million square feet under one roof. In 1992 we made the commitment to invest over $60 million in this facility and new equipment.

This year alone, Fruit of the Loom will spend almost $300 million worldwide on new facilities and state-of-the-art equipment.

We are addressing the global competitive issue by participating in a number of industry programs, as well as developing technology programs proprietary to Fruit of the Loom.

We are a member of AMTEX, a role model for industry, government and academia working together toward a common goal. By capitalizing on existing resources, AMTEX believes technological advances can be developed and deployed, increasing the competitiveness of the nation's soft goods industry.

Fruit of the Loom is also a member of TC-Squared, an organization of textile and apparel representatives working to develop advanced automation for the industry.

In 1993, Fruit of the Loom acquired JewSew Technologies, a leader in developing state-of-the-art technology. This firm has 111 full-time employees developing custom automation for Fruit of the Loom and other apparel companies.

We also have an R&D center at our headquarters in Bowling Green, KY, developing proprietary equipment to give us a competitive advantage over foreign and domestic competitors. All of this technology and other innovation has helped to reduce our production costs by as much as 30 percent in the past eight years.

These are a few examples of the steps Fruit of the Loom has taken to ensure our competitive edge and leading position in the global marketplace.

Federal and state agencies, however, can assist Fruit of the Loom and our industry in creating American jobs and enhancing our competitive position by:

1. Providing incentives and resources for job training and retraining programs;

2. Addressing the high cost imposed by greater government regulation;

3. R&D tax credits similar to those provided by foreign governments to their businesses and industries;

4. Providing additional access to R&D resources through a refocusing of research and scientific talent, formerly devoted to technology developed for NASA and the defense programs, similar to what is available through AMTEX;

5. Seeking greater industry input in drafting legislation that impacts domestic and international trade.

Fruit of the Loom has made a tremendous investment in technology, particularly in the U.S. We are committed, more than ever, to building our U.S. manufacturing base. However, we are concerned about the growing impact of low-cost labor in foreign markets on our U.S. manufacturing base. Our company, as well as our U.S. competitors, will find it difficult to endure the concessions that they are being asked to make under trade agreements such as GATT. We must continue to work together to promote market access and develop technological expertise. These partnerships are an integral part of our efforts to strengthen our industry's worldwide competitive position, and we applaud the efforts made to-date.

Again, we appreciate the opportunity to share Fruit of the Loom's position and look forward to working together to achieve greater U.S. competitiveness for our industry. Thank you.

[The prepared statement of Mr. Wigodsky follows:]

TESTIMONY OF

JOHN WIGODSKY

EXECUTIVE VICE PRESIDENT - OPERATIONS
FRUIT OF THE LOOM, INC.

DURING THE INVESTIGATIONS AND OVERSIGHT HEARING OF THE
SUBCOMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES

LAFAYETTE, LOUISIANA

JULY 7, 1994

Good afternoon. I am John Wigodsky, Executive Vice President, Operations of Fruit of the Loom. We are extremely pleased to be part of this forum and to have the opportunity to promote competitiveness in the American textile and apparel industry.

Founded in 1926, Fruit of the Loom (FTL-NYSE) is one of the leading textile and apparel companies in the world. Fruit of the Loom had sales of $1.8 billion in 1993 and employs over 34,000 workers in more than 50 locations worldwide. However, 85 percent of our production is generated by our 30,000 domestic workers at facilities in the U.S.

Fruit of the Loom is a vertically integrated company, performing every process of production, from yarn-spinning to the sewing of apparel. We are the largest consumer of cotton grown in the U.S., using more than 800,000 bales of cotton every year. With four of the largest autocoro spinning operations in the world, we spin over 4 billion miles of yarn a year. Fruit of the Loom workers sew in excess of one billion garments a year, averaging 151 garments a second.

In order to maintain our leadership position, Fruit of the Loom has invested over $1 billion in new plants and equipment in the past six years. We have also created over 20,000 new jobs in the U.S. during that same time period.

However, Fruit of the Loom is extremely concerned about the impact of the General Agreement on Tariffs and Trade (GATT), and the threat it poses to the American textile and apparel industry. Two million American jobs, located mostly in the southeastern part of the U.S., are at tremendous risk because of this trade agreement.

The agreement phases out textile and apparel duties and tariffs that have historically protected American jobs from low-wage competitors in foreign markets. It will allow large numbers of foreign made products to enter the U.S. market at lower prices, but U.S. manufacturers will not have equal access to large markets in developing countries such as China and Pakistan. For the American textile and apparel industry, it is a lose/lose situation.

Fruit of the Loom is committed to its U.S. manufacturing base, but must continually look for ways to remain competitive, especially in light of U.S. competitors moving jobs offshore.

Fruit of the Loom has strengthened its competitive edge by increasing efficiencies and enhancing the quality of our products. A substantial part of our investment in technology is being made here in the southeast:

Louisiana - FTL employs over 7,000 workers at five facilities. We announced last year an investment of $50 million for a new, state-of-the-art manufacturing plant and distribution center, currently under construction in Vidalia.

Texas - We have created more than 2,000 jobs since 1990 for American workers in Harlingen and Raymondville.

Georgia - Rabun Gap, Georgia is home to FTL's largest facility with over one million square feet under one roof. In 1992 we made the commitment to invest over $60 million in this facility and new equipment.

This year alone, Fruit of the Loom will spend almost $300 million worldwide on new facilities and state-of-the-art equipment.

We are addressing the global competitive issue by participating in a number of industry programs, as well as developing technology programs proprietary to Fruit of the Loom.

We are a member of AMTEX, a role model for industry, government and academia working together toward a common goal. By capitalizing on existing resources, AMTEX believes technological advances can be developed and deployed, increasing the competitiveness of the nation's soft goods industry.

Fruit of the Loom is also a member of TC^2, an organization of textile and apparel representatives working to develop advanced automation for the industry.

In 1993, Fruit of the Loom acquired JewSew Technologies, a leader in developing state-of-the-art technology. This firm has 111 full-time employees developing custom automation for Fruit of the Loom and other apparel companies.

We also have an R&D center at our headquarters in Bowling Green, KY, developing proprietary equipment to give us a competitive advantage over foreign and domestic competitors. All of this technology and other innovation has helped to reduce our production costs by as much as 30 percent in the past eight years.

These are a few examples of the steps Fruit of the Loom has taken to ensure our competitive edge and leading position in the global marketplace.

Federal and state agencies can assist Fruit of the Loom and our industry in creating American jobs and enhancing our competitive position by:

-- Providing incentives and resources for job training and re-training programs;

-- Addressing the high cost imposed by greater government regulation;

-- R&D tax credits similar to those provided by foreign governments to their industries;

-- Providing additional access to R&D resources through a refocusing of research and scientific talent, formerly devoted to technology developed for NASA and Defense programs, similar to what is available through AMTEX;

-- Seeking greater industry input in drafting legislation that impacts domestic and international trade.

Fruit of the Loom has made a tremendous investment in technology, particularly in the U.S. We are committed, more than ever, to building our U.S. manufacturing base.

However, we are concerned about the growing impact of low-cost labor in foreign markets on our U.S. manufacturing base. Our company, as well as our U.S. competitors, will find it difficult to endure the concessions that we are being asked to make under trade agreements such as GATT.

We must continue to work together to promote market access and develop technological expertise. These partnerships are an integral part of our efforts to strengthen our industry's worldwide competitive position, and we applaud the efforts made to-date.

Again, we appreciate the opportunity to share Fruit of the Loom's position and look forward to working together to achieve greater U.S. competitiveness for our industry.

# # #

FACT SHEET

CORPORATE HEADQUARTERS:	FRUIT OF THE LOOM, INC. 233 South Wacker Drive 5000 Sears Tower Chicago, IL 60606 (312) 876-1724
OPERATING HEADQUARTERS:	FRUIT OF THE LOOM One Fruit of the Loom Drive Bowling Green, Kentucky 42102 (502) 781-6400
CORPORATE DESCRIPTION:	Fruit of the Loom, acquired by Farley, Inc. in 1985, is a publicly traded company on the New York Stock Exchange (FTL). Fruit of the Loom is a leading international manufacturer and marketer of family apparel including activewear, casualwear, sportswear, underwear for men, boys, ladies, girls and infants, as well as family socks. The Company sells products under the brand names of Fruit of the Loom®, BVD®, Gitano®, Screen Stars® and Best®. Licensed brands include Munsingwear™ and Wilson®. Sports-licensed apparel is designed and manufactured by Salem Sportswear Corporation and Artex Manufacturing Co., Inc., subsidiaries of Fruit of the Loom, Inc.
EMPLOYEES:	Employment has more than doubled at Fruit of the Loom since 1985, increasing from 13,000 to over 34,000 employees today.

One Fruit of the Loom Drive
P.O. Box 90015
Bowling Green, KY 42102-9015 502-781-6400

PLANTS AND FACILITIES:

Fruit of the Loom has facilities in over 50 locations. The company's manufacturing facilities are located in Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, New Hampshire and Texas. They are also located in Honduras, Canada, The Republic of Ireland and Northern Ireland.

1993 FINANCIAL HIGHLIGHTS:

Annual sales of $1.8 billion and net earnings of $381 million were reported in 1993.

CONTACT:

Pamela L. Blankenship
Director of Communications
502-781-6400 ext. 2159

Rev.
6/94

Mr. HAYES. Thank you. I will just make a couple of observations rather than a question.

First of all, this company has a very impressive and very outspoken and eloquent CEO in Chicago, Illinois who articulates best the case that here is a corporate entity that was very much in favor and in fact spearheaded some of the efforts on NAFTA, by leading the charge, by saying that they had no intention and would not cut their U.S. work force in general and their Louisiana work force in particular. They have not only made that commitment but kept it as they have expanded since the passage of the North American Free Trade Agreement.

On the other hand, they are not at all afraid of global competition and they will tell you that the provisions which they supported in the General Agreement on Tariffs and Trade was a longer term phase-out, not the inability to handle their competition. They simply opposed handling it day one, or on such a short-term that they would not be able to put into place all the efforts that we are talking about and blending technology while still holding work force at higher levels of pay and a higher standard of living.

So they are not opposed to facing their foreign competitors, they are opposed to facing their foreign competitors with one hand tied behind their back and with still in effect subsidies that governments are giving their own competitors of ours, which we do not have the equivalent of.

The Tax Reform Act of 1986 altered provisions on the manner in which research and development could be expended by corporations, has not added a dime to the federal Treasury, and in my opinion has cost hundreds of thousands of American jobs through the inability to be able to go forward with additional R&D as fast as we should have, and especially at a time that we had a down economy.

Having said that, I will also mention that I have said it without knowing what you were going to say, so you can tell your CEO he has done a very good job in convincing me.

Thanks very much for your participation as well, and I especially also want to comment upon the agricultural partnership in Vidalia, Louisiana. What it represents is really the realization that you can look out of the windows of their facility and see the cotton product that is going to ultimately be transformed into an apparel line and a textile line. That is—thinking through the process, Henry Ford would have been so proud of them in Vidalia. He is literally taking it from the ground up all the way through the finished product, with everything from local agriculture to all the steps in between.

Thanks again for coming and because of our time constraints, we have other panels, I am going to jump right ahead to Mr. Moore, who is the Executive Vice President of the American Textile Manufacturers Institute. And I hope he will talk about some of the initial partnerships that they have had here with the University, as a case study example of how the concept that we are discussing today actually works.

Once again, Mr. Moore, thanks, and we look forward to your testimony.

STATEMENT OF CARLOS MOORE, EXECUTIVE VICE PRESIDENT, AMERICAN TEXTILE MANUFACTURERS ASSOCIATION, WASHINGTON, DC

Mr. MOORE. Thank you, Mr. Chairman. I am here on behalf of the American Textile Manufacturers Institute, which is located in Washington, D.C. We are the national trade association for the U.S. textile industry. Our member companies operate in more than 30 states, including Louisiana, and we account for about 80 percent of all the textile fibers that are consumed in this country by textile mills. We employ about 670,000 workers and contribute nearly $22 billion to our gross domestic product.

While we do not have a lot of textile manufacturing operations in Louisiana, we do have some very close ties. Secretary Reilly, earlier this morning, mentioned the important role Louisiana plays as a supplier of cotton and chemicals to our industry. We buy nearly all of the cotton grown in this state. Our industry also has in this state many customers for our yarns and fabrics. There are many apparel-making operations such as Fruit of the Loom, which as you know, also makes yarns and fabrics and is a member, I am proud to say, of ATMI.

The products that our members make are not apparel, not clothing, but they are fabrics and yarns which go into those uses. They also make home furnishings, the sheets, towels, pillow cases, carpets, draperies that you use and see every day. We also make a wide variety of industrial and automotive type fabrics that go into many, many different manufacturing industries.

What I would like to talk about today is really how we use technology-based operations to maintain our competitiveness. It is a real pleasure for me, Mr. Chairman, to be here today to talk about that because it has a personal connection for me also, to get back to south Louisiana. I was born and raised in Opelousas and even though I attended another university, it has the same initials but they are slightly rearranged, I have to say that USL has taken on increasing significance for me and for our industry over the past few years.

We have been focusing as an industry in computer-integrated manufacturing. And several years ago, we formed a subcommittee of our members to review what role we could play as an industry association in helping our industry advance in this higher technology area, and therefore become more competitive. In 1992, ATMI and USL, through your President, Dr. Authement, signed a Memorandum of Understanding and we established some projects here at the CIM Center, this very building, at USL. Several factors really impressed us the most in making our decision to do this.

First of all, there appeared to us to be a clear commitment by the state of Louisiana to emphasize and support research. And I might add, that is not true in every state of this union.

And secondly, we found the attitude at USL to be extremely cooperative in wanting to work with industry together to shape a research agenda. We found that USL has a proven record, a demonstrated record, in computer-integrated manufacturing research and development and the center's director, who you will hear from later, Mr. Al Steward, has brought industry experience and technical expertise in this area.

Our initial project which is underway, is really to find the best ways to connect information that comes form different pieces of machinery in this process of making textiles, to take that equipment—that information, excuse me, the electronic signals, and to use them efficiently. That is, to use them in a way that is not affected by the type of equipment, by whether it was made in Switzerland or Japan or the U.S., and to be able to establish standards so that every textile company can use these electronic signals from this equipment during the process to make textiles more efficiently and with fewer defects, higher quality.

In a nutshell, that really is our first project here. It is a challenge that this industry is confronted with and we believe it is a challenge that we can solve through working with USL and the CIM Center here. We are going to start out with the yarn-spinning operations, which is the early stages of textile manufacturing, and we hope to be able to build on that and go through the subsequent stages of weaving and finishing and so forth.

We would like to also establish those findings, those recommendations into, as I said, voluntary standards for our industry, so that all companies can profit from this research and improve the way that textile are made in this country.

We have also applied to the American National Standards Institute to become a standards developer, as a preliminary stage to using the information gained from the USL project to develop these standards and thereby make it easier, as I said, to compete for our companies.

We really appreciate the support and interest that both the state and the university have shown in this project and on earlier projects involving apparel, data standards such as we are talking about.

This morning, we toured the Apparel CIM Center and we saw some apparel projects that involve the latest technology. I had not been here for over a year and really could not believe the tremendous advances that had taken place over that time. I am convinced that our industry will extend our research involvement with USL into new and other exciting areas.

I would like to mention one other important project or program that has been mentioned several times this morning, and that is a partnership that our industry, our broad industry, has entered into with the Department of Energy's national laboratories. You heard Mr. Lewis mention it and Mr. Wigodsky just now has also mentioned AMTEX. We believe that this project will allow us to tap into the resources of the Department of Energy's national laboratories such as Los Alamos, Lawrence Livermore, Sandia, Berkeley, Oak Ridge, on and on, to tackle some technology problems that really the expertise at those laboratories can very productively and very efficiently deal with. We have a number of projects underway involving some computer-aided fabric inspection, rapid cutting technologies, some flexible or agile manufacturing, as we heard earlier. We are also developing, with the laboratories, a model computer network that would link the entire chain and try to optimize the processes and flows of material from fibers all the way through to retailing.

We are also working with other universities that have been mentioned in the past and with TC-Squared in other projects. But I think that as we move into these higher technology areas—and I think our industry will certainly continue to move in that direction—we have a real challenge to maintain a highly skilled work force. And one of the programs that we are embarking on is an apprenticeship program to develop and improve skills of our workers to maintain and service the high technology equipment. We will be establishing a pilot program very soon in that area, and from what I have seen today, I think there probably are some things here at the CIM Center that we might want to look into as being supportive of that program. And we will be examining that in the near future.

In summary, I would like to conclude, Mr. Chairman, by saying that we believe our industry has a bright future, it must be based on new technology. We plan to use the very latest technological developments to continue to hold onto our position as the most productive textile industry in the world. We are proud of our record in the past and we believe through cooperative efforts like we have with institutions such as USL, that we can go forward and continue to be highly productive.

I want to mention and follow up very briefly that Mr. Wigodsky expressed concern about the international trade negotiations under the GATT and the adverse impact that this can have on our industry. We share that concern and we are working with members of Congress and the administration, members such as yourself, to try to fashion the implementing legislation of that agreement in a way that lessens the damage as much as possible. So we look forward to continuing to work with you. We thank you for your support on past trade initiatives such as NAFTA, and we will continue to try to find ways that we can be more competitive and continue to be a major employer of U.S. workers in the future.

Thank you.

[The prepared statement of Mr. Moore follows:]

TESTIMONY OF CARLOS MOORE

EXECUTIVE VICE PRESIDENT

AMERICAN TEXTILE MANUFACTURERS INSTITUTE

BEFORE THE

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

**"Beating the Competition at Our Own Game:
Technology-Based Advances in Manufacturing"**

JULY 7, 1994

LAFAYETTE, LOUISIANA

My name is Carlos Moore. I am Executive Vice President of the American Textile Manufacturers Institute (ATMI), the national trade association for the domestic textile industry. Our member companies operate in more than 30 states, including Louisiana, and account for approximately 80 per cent of all textile fibers consumed by mills in the United States. The textile industry in this country employs 670,000 workers and contributes approximately $21.7 billion to our country's gross domestic product.

It is a pleasure to testify before the Investigations and Oversight Subcommittee about technology-based advances in the textile industry. The U.S. textile industry, the world leader in textile productivity, achieved this distinction many decades ago by using the very latest technology in an ongoing effort to gain and maintain a competitive advantage over foreign producers. I would like to report today on new technology-based advances underway that will keep the U.S. textile industry in the position of leader in productivity and efficiency.

One of the key technology areas for the U.S. textile industry today is computer integrated manufacturing (CIM). Several years ago ATMI formed a subcommittee of its members to review the overall role of CIM for the textile industry and to consider establishing a CIM system which will enhance the competitiveness of U.S. manufacturers.

In 1992, ATMI and President Ray Authement of the University of Southwestern Louisiana (USL) signed a Memorandum of Understanding establishing a Textile CIM Center on the campus of USL and setting forth goals and expected benefits from this Center. Our overall objective is to advance the level of knowledge available to the ATMI member companies and encourage improvements in domestic manufacturing. We believe both of these objectives are being met.

USL has a proven record in computer integrated manufacturing and the Center's director, Mr. Al Steward, has industry experience and technical expertise. Our initial project is to find the best ways to connect "islands of information" electronically during the production process. Our industry needs an efficient, inexpensive way to take electronic signals from one machine and send those signals to another machine in the process in order to produce more at higher quality. We also would like to be able to establish this in a standardized way that would be accepted throughout the industry. We found that the lack of CIM standards for textiles was a major obstacle to greater competitiveness.

Using electronic means, the textile industry is working on a CIM system that will allow textile manufacturing machines to "talk" with other manufacturing machines. This will make it easier to control variables in the process and produce textiles more efficiently and with fewer defects.

As the first stage of establishing a CIM system, we have a pilot program underway in yarn spinning which is expected to lead to voluntary standards for that segment of the industry. The first step of this program at USL is to identify the types of data or information needed to allow machines to talk to machines for monitoring manufacturing processes as the products are being made.

We will then begin to establish voluntary standards that will enable all yarn manufacturing machinery manufacturers, whether domestic or foreign, to provide their customers with interconnection systems to monitor and adjust manufacturing continuously.

Our plans are to expand the standards development process to weaving, knitting and other manufacturing operations over time.

Simply stated, we are working with USL to establish "black boxes" that will generate electronic signals to control the overall textile process -- regardless of what the manufacturing equipment does or who makes it. The competitive advantage of being able to do this for the entire textile manufacturing process is enormous.

ATMI has also applied to the American National Standards Institute (ANSI), which is the U.S. representative to the International Standardization Organization, to become a

voluntary standards developer. Once the voluntary standards are developed through ANSI, we plan to seek international adoption of these standards. Consequently, the domestic industry will have the ability to develop voluntary standards based on the most advanced technology available anywhere in the world.

This will create competitive advantages for our industry and make our workers' jobs more secure. We appreciate the support and interest of USL and the State of Louisiana in working with us on this project.

Let me mention one other major technology-based program -- The American Textile Partnership, known as AMTEX. AMTEX is a collaborative research and development partnership between the U.S. textile industry and the U.S. Department of Energy's (DOE) National Laboratories. Its far-reaching research projects involve nearly 200 scientists from the national labs and our industry.

The partnership covers the complete chain of manufactured textile products from textile fibers through retail sales, and the various projects include industry participation from all sectors. Over 100 U.S. companies are now participating and the list continues to grow.

World-renowned DOE National Laboratories such as Los Alamos, Lawrence Livermore,

Sandia, Berkeley and Oak Ridge are working with the textile industry to tackle technology problems with the objective of making the U.S. textile industry even more competitive worldwide. Current projects address computer-aided fabric inspection, rapid cutting technologies and sensors to aid in flexible manufacturing. A model computer network linking all industry sectors from fiber through retail is also being developed.

In addition, our industry works closely with the National Textile Center. This organization is a research consortium of four universities -- Auburn University, Clemson University, Georgia Tech and North Carolina State University -- which provide academic research to improve the competitiveness of the U. S. industrial complex. These four universities share personnel, equipment and facilities to attain common research and educational goals.

With the quantum leaps in technology that drive today's textile industry, we're examining ways to develop and maintain a skilled work force. ATMI is embarking on an apprenticeship program to train maintenance workers to service our sophisticated machinery and our pilot program will begin soon.

In summary, we are looking to a future based on new technology. We plan to use technology-based developments to continue to hold our position as the world leader in

textiles and we're proud of our record of accomplishment. We also value the joint program we have with USL in computer integrated manufacturing and look forward to working together to develop solutions to the U.S. textile industry's future manufacturing issues.

I appreciate the opportunity to testify before this Subcommittee and will be pleased to answer any questions.

Mr. HAYES. Thank you very much.

There is not really any other question. What you might want to elaborate on though—you would be more up to date with it—the period of time in which and the phases which would occur in the textile industry is not very far apart from what you would like to do and what you feel would be competitive. Would you elaborate on the numbers, because I do not want to misquote the durations and the phase-ins that were originally discussed in the textile industry and then to what degree they vary in the current GATT agreement.

Mr. MOORE. Well we, Mr. Chairman, had taken a position early on that the Uruguay Round of GATT talks, as it was called, posed some very big problems for us. They wanted to—they meaning the negotiators from 112 countries—wanted to open up our market to textile and apparel imports very rapidly. To do this without any safeguards or protection because of the adverse impact that might cause on U.S. employment and U.S. production. We suggested that if they were going to do this, we should have a 15-year period of time in which to really almost completely open up our market to imports. It turned out that we got what is on paper a 10-year phase-out, but it operates in such a way that after about seven years, we have very little import protection left from foreign producers.

The real problem with all that is that many of those producers who are going to have greater and greater access to our market, continue to keep their markets closed to our product.

Mr. HAYES. That is the point I wanted you to make.

Mr. MOORE. And I finally got to it.

Mr. HAYES. I want you to make it very clear that it is not bilateral.

Mr. MOORE. It is not like NAFTA. NAFTA is a reciprocal two-way agreement. We opened our market, Mexico opened theirs. And I might say that since January, Mexico has become our biggest export market. It has passed Canada as our export market for textiles. Here you have two countries agreeing to open their markets jointly, but in the GATT talks, we have China, India and Pakistan refusing to open their markets to our products at all, and yet they are going to be able to ship more and more here and take away our production and our jobs. And that is going to be a major problem for us. We are going to try to overcome it with technology, with R&D, with being the best, the most productive industry, but when you look at the inequities that exist out there between the major textile and apparel producing countries in the world with closed markets and our market being open to them, we believe that we need to try to get all of the information out about this that we can and we are going to try to seek real meaningful assistance from the Congress and from the administration on this basic inequity.

So I think that describes the dilemma we are in, Mr. Chairman.

Mr. HAYES. Thanks very much.

We are going to head to our next panel. I appreciate very much all of you being here and I know you took a lot of time but I am also glad that you had the opportunity to see this place, in some instances to see it again. I think you have found that its evolution has been very rapid over the last few years as well.

Did we have a card big enough for Fenstermaker? Did we have to add paper for that?

Our last panel is really an example of each of the triads in this partnership. Al Steward, to whom you have heard earlier reference, is the Director of the Apparel CIM Center here at the University of Southwestern Louisiana; Mr. Cummins is the Vice President of the National Center for Manufacturing Sciences here from Washington, and Bill Fenstermaker with Fenstermaker & Associates here in Lafayette, has also been extremely active in a program with which you will become more familiar during his testimony. But they represent the three links of the federal, the business and the local industrial use, and the expansion of technology and its sharing.

With that, once again, I think it might be as appropriate in heading down that aisle, I will begin with Mr. Cummins, and look forward to each of your testimonies accordingly, and thank you for coming.

STATEMENTS OF MICHAEL G. CUMMINS, VICE PRESIDENT, NATIONAL CENTER FOR MANUFACTURING SCIENCES, WASHINGTON, DC

Mr. CUMMINS. Thank you, Mr. Chairman. I represent the organization known as the National Center for Manufacturing Sciences. We are actually based in Ann Arbor, Michigan and I represent them in Washington in terms of working out the partnership with the federal government.

We are probably the largest manufacturing technology R&D consortium in the country. We were formed back in 1986 by an Executive Order of the President in a plan that was put together by the Department of Defense and Department of Commerce to support the U.S. machine tool industry. At that point in time, in the late 1970s and early 1980s, the U.S. machine tool industry was being seriously devastated by foreign competition. At that point in time, a decision was made both to put up some trade restrictions as well as to establish an organization on the technology side to start looking at technologies for that industry.

I think we are a lot different than what we started out to be. We are a much larger organization than I think was ever expected. We are much broader than the machine tool industry now. We have in our membership the automobile companies, electronics firms, communication companies, aerospace, chemicals. I would say that our niche in this whole area—and it was somewhat brought up today in several of the testimonies—is we work across industries. So as where AMTEX and the textile people have their own specific technology focus, we look at areas that are generic, problems and needs that cross industries. And in the area of manufacturing, those needs are great and they cross many bounds.

We are very involved in the federal government since basically our charter was drafted up under the auspices of the National Research Council with both industry and the government sitting at the table, to come up with a plan as to how we would start attacking this problem. I think back in those days the problem was perceived to be much smaller than it really is, and there is a lot of awareness—since I have been in Washington since 1986, I came

from the automobile industry, and I just do not think in the area of manufacturing technology, that there was the correct perception there of the size of the problem.

Since then, we have identified that quite well. We have worked with the Department of Commerce in the Advanced Technology Program and the Manufacturing Extension Program and the standards area. We have worked with the Department of Defense in the MAMTC Program, with ARPA in different research areas. We work with the Department of Energy, we have a broad generic CRADA that covers many different technologies.

In general though, I know we are here to talk about Louisiana and I have to apologize. Prior to the invitation to speak here, I knew very little about the state and its manufacturing. And I think my initial perception was manufacturing and Louisiana did not necessarily mix. We have an extensive research center, I mean an extensive information center. And I had them dig up some information and actually had some—I was impressed by what I found.

First of all, I would say that I looked at the competitiveness of this area. I was looking at one study that we had obtained awhile back that was produced by the Department of Commerce, and I wanted to use that as an example regarding where manufacturing goes, because there is not a great deal of information—we hear a lot about prime contracts and other things, for instance, that the government buys and where that manufacturing is done. But there is very little information in the sub-tiers. So I had my staff pull out this study and I said tell me where Louisiana stood in manufacturing. And what the Commerce Department had done is they analyzed three weapon systems and this report was published back in 1992. I have never seen anything like it since or before that.

But what it showed is the state of Louisiana actually beat out 36 other states in total manufacturing on these particular weapons systems. They were not the prime contractors, but at the sub-tiers, second, third and fourth tier of those systems, Louisiana actually did quite well. I started to look at that though, and actually one of the purposes in this study was to look at foreign sourcing and foreign dependency. And what they had found was that there really was not necessarily foreign dependency except in a couple of areas. But what I did find in there, and I bring this up normally when I speak at different meetings around the country, is that if we look at, for instance, the state of Louisiana, for every taxpayer dollar that was used in these weapons systems, although they came out better than 36 other states, for every job that that taxpayer dollar produced, the Louisiana taxpayer dollar produced, they produced three jobs in Japan, two jobs in Canada. And if you just looked at those two countries, for every job that was produced here in Louisiana, five jobs were produced in other countries—at least five, and it is really quite a bit more. Now granted, these were just three weapons systems and relatively small weapons systems that were looked at. I think if they looked across the board, if they could afford to do such a study, they would find a very similar situation.

And I am not here to promote, although I do agree with the last panel on the situation in GATT and there are a lot of problems with this current agreement I believe, but I would like to focus on the three reasons, instead of trying to promote protectionism,

which I find now in Washington to be a dirtier word than industrial policy, I would like to talk about the reasons why that work is going offshore. And what this study did is it looked at every single purchase, be it components or subsystems or whatever that was bought and why they were bought. And what it shows is that the number one reason was cost, they have a cost advantage. The number two reason was quality. And about fourth on the list, and this is in total, was delivery time. To me, those are—there were other reasons, there were about ten different reasons listed—offsets is one of them, if you are familiar with the offsets that are set up between governments and companies. Sometimes it is considered to be the most important reason, but according to this study it was not. The two most important reasons were cost and quality. Those are competitiveness issues. Those are issues we can address with technology.

So I could go from there to say—and if I look at the NCMS, we have I would say right now existing about 90 different technology programs. We are program managers, we do not perform the research. The Fruit of the Looms and the Northrop Grummans and those companies themselves. What we do is we facilitate bringing the government and industry together to put together these programs, so we are program managers in that regard. We have got about 80 different programs and I have got a whole list of them here. And I could run through these things, technology by technology and these are some really impressive programs. We are talking about hundreds of millions if not in some cases, in one project alone I have one company, Ford Motor Company will save a billion dollars if that program is successful. It is called Predictive Heat Treat.

But instead of going into a lot of the technical details, what I wanted to look at is, all of these programs either address cost, quality, delivery time or all of the above. Technology can have a significant impact on that.

So where do we fall short here in the United States? If we take a look at—NCMS has taken a very serious look, and in my written testimony, you can see a lengthy discussion about the innovation cycle. From basic research moving through applied research on through development, commercialization, deployment, adoption of the technology. We do extremely well in the United States, we always have on the early end, the early side of that innovation cycle, basic research. And the government has always been quite involved in that through the National Science Foundation and the Department of Defense.

If you look at the costs going through that cycle, you see the costs going up. As you go from basic research to applied research, development, commercialization and finally deployment—tremendous amount of cost. On the other hand, you see the government support coming down like this, industry of course having to pick up the ball as you go on.

What we found when we took a look at our foreign competitors is their support does not necessarily come down, it is much more level. As a matter of fact, they skip pretty much that first part. They come and source technology, the research, from us at maybe 20 cents on the dollar. And then they take the savings—they are

more efficient in the research that they do in the middle levels there and they do a tremendous amount more of what we do here at the NCMS, which is collaborative research and there is a greater efficiency in bringing many companies together like in the program at TC-Squared and AMTEX, to do this stuff collaboratively. And finally, they have set up an infrastructure—and I am not just talking about Japan, but you can find this in Germany, in Singapore and Taiwan—an infrastructure to support the deployment of technology. In other words, an infrastructure that is set out there to find ways to provide patient capital, to provide ways of providing the training of the work force to adopt the new technologies, many of the things that were discussed here today.

I think we have the makings—to conclude my statement, I think we have the makings, quite frankly in some of the things that are on Capitol Hill right now that have been launched several years ago in the Advanced Technology Program of the Department of Commerce, the Manufacturing Extension Program, as well as these collaborative programs with the federal labs. I think one of the most important things there—there are things occurring in those programs that if they did not exist, if the federal government was not involved, they would not occur, and they happen to be at the downstream stage of the cycle because companies themselves have a very difficult time commercializing.

In our own organization, and if I look at the technology that we developed, we had federal resources involved. If there was no federal resources, that technology would not go beyond the membership, there would be no incentive, no reason for them to deploy that technology further. But because federal resources are involved, you can push that technology out and put that requirement in there. That is one of the requirements that is in the Advanced Technology Program, and without the federal resources and federal involvement, it would not be there. So I think the strong support of that program is very important.

If you look at the Extension Program, I mean I think it is really appalling that we have not put the attention on the deployment side. I think the Extension Program needs to be expanded significantly. It needs to do more, it needs to be expanded in scale as well as scope, and I think that is going to be—I understand in the budget situation it is very difficult, but we do have a problem in getting technology out to our small and medium sized firms. We have got to get much more involved in the training area in bringing organizations like USL and other community colleges and state colleges around the country, universities, involved in working with industry to help educate both the new work force as well as the existing work force.

Mr. Chairman, I would be happy to answer any questions.

[The prepared statement of Mr. Cummins follows:]

Statement of Michael G. Cummins
Vice President
The National Center for Manufacturing Sciences

Before the Subcommittee on Investigations and Oversight
Committee on Science, Space and Technology
U.S. House of Representatives

On Beating the Competition at Our Own Game:
Technology-Based Advances in Manufacturing

July 7, 1994

As Vice President of the National Center for Manufacturing Sciences (NCMS), I work for the nation's largest manufacturing research and development consortium. The NCMS is a not-for-profit industry-led partnership consisting of manufacturing organizations, federal and state government instrumentalities, academic institutions and civic organizations working to achieve an unparalleled level of competitiveness for U.S. industry. This is accomplished through investment in new technology development, expediting the rate of new and existing technology adoption and deployment, and maintaining and upgrading the skills of the manufacturing workforce.

Started in 1986 as an effort to restore the nation's then nearly extinct machine tool industry, the NCMS has grown to include nearly 200 corporate members covering the full spectrum of the U.S. industrial base. Some of the industries represented in the NCMS include aerospace, automotive, computers, chemicals, healthcare, electronics and telecommunications.

The collaborative research and development projects occurring under the guidance of the NCMS fall into one of six Strategic Initiative Groups, or SIG's as we refer to them. These include Computer Integrated Operation which is concerned with information and technology systems, Manufacturing Processes and Materials which is focused on the rational applications of innovation process technologies, Production Equipment and Systems which explores developments of technological advancements of manufacturing equipment, Management Practices which addresses important business concerns, such as education and training, and accounting and quality practices, Environmentally Conscious Manufacturing which is managing a portfolio of research and development activities to address member environmental concerns related to manufacturing, and finally Electronic and Concurrent Manufacturing which seeks to facilitate collaborative development and implementation of electronics systems and manufacturing processes.

Examples of current NCMS research projects range from the Machine Tool accuracy Initiative which seeks to develop a method to measure machine tool accuracy, establish a software tool to compensate for errors in equipment, and evolve a means to analyze specifications for machine tools internationally, to Rapid Prototyping Technology Advancement which seeks to improve the capability of the stereolithography process, investigate alternate rapid prototyping systems, advance the ability to use replicas as the pattern, master

and tool for the functional item, and develop the ability to go directly from computer-aided design to metal.

In its short history, the NCMS, through its collaborative model, has been able to effect some tremendous successes. The Printed Wiring Board program seeks to build circuit boards good enough to keep pace with the changes in silicon chip technology, and regain lost market share for the domestic PWB industry, which fell from 42% to 27% in only 7 years. This five year, $33.6M venture is funded as part of the Advanced Technology Program (ATP) competition of the National Institute of Standards and Technology (NIST) . $5.2M of the funding is supplied by Sandia National Lab, with approximately one half of the remaining funding coming from NIST, with a match from industry.

The effort has produced some dramatic results to this point. Through collaboration the teams have avoided redundant research, saving an estimated 80 work years, have saved more than $2M in equipment and machine-time savings, and have documented that the adoption of improved practices has been reduced by 13 months. In addition, the teams also estimate a 30% increase in productivity in 5 major project areas. This program has produced a state-of-the-art research network that is transferring technology back into the U.S. industrial sector. This collaborative ATP project, led by the NCMS, has done nothing less than leveled the international playing field and recharged a U.S. industry.

In addition, the NCMS has created an unparalleled level of cooperation with the Department of Energy (DOE) Laboratories through the DOE/NCMS Generic Cooperative Research and Development Agreement (CRADA). This unique "master" CRADA has been written and approved between the NCMS and DOE and its four Defense Program Labs. This CRADA allows multiple R&D projects to be undertaken through a streamlined process, with the result being the effective transfer of knowledge in the federal labs to U.S. industry. The DOE has contributed $10M to project funding with the NCMS providing matching funds. Project areas are identified by the critical needs of industry, and currently include advanced bioremediation, rapid response manufacturing, and development of alternatives to lead-based solders.

The most crucial element in the successes brought about by the NCMS is the industry-led collaborative model which NCMS and its partners have refined over the past six years. This model enables all participants involved with technology creation, deployment and

implementation to actively participate in the decision making process. Within this framework, technology is transparently transferred to end-users by their involvement in generating the R&D programs which are critical to their competitiveness. The success of the NCMS in generating and deploying advanced manufacturing technologies ensures the continued growth of the organization, the collaborative model and the competitiveness of U.S. industry.

As a national consortium, we keep track of, through our extensive manufacturing information resource center, manufacturing statistics and related data on each of the states. According to the " 1994 State Report Card" of the Corporation for Enterprise Development, the state of Louisiana is experiencing strong manufacturing capital investment and new business job growth. These indicators have been on the rise in recent years and if the trends continue, there is potential for more economic growth and development.

Within the state, the seventh district of Louisiana is doing well with a strong oil and chemical industry and a growing aerospace sector with the arrival of Grumman to the area. In addition, the timber industry continues to employ a number of people in the district.

But economic problems do exist in the state and in the seventh district, as is the case in almost any Congressional district in the country. America's competitiveness depends on our ability to obtain and utilize technology and provide high-skill, high-wage jobs for our citizens.

If we compare the use of new technology in manufacturing by small and medium size enterprises in Japan versus the United States, we can see that the US is not adopting technology at a rate comparable to our trading partners. For example, Japan's small and medium sized companies use CNC machine tools at a rate twice that of the United States companies. Japanese companies also employ handling robots and assembly robots 11 times more than American companies.

This should come as no surprise when we examine the statistics on investment in plant and equipment. According to the Council on Competitiveness, from 1972-1991 Japanese investment grew almost 3.5 times as much in real terms as compared to the United States. Of all the other G-7 countries, only France has had slower investment growth over the past twenty years than the United States. In addition, from 1990-1991, US investment declined about 7 percent in real terms. This is in sharp contrast to Germany and Japan, where

investment grew by 9 and 6 percent, respectively. Without this investment in plant and equipment, and the adoption of new technologies, manufacturers in the United States will have a tough time competing in the global marketplace.

Alot of attention today is directed to dismantling the structural barriers to exporting to Japan. But we must remember that these barriers, although they have an impact on what we can sell, they have little to do with what we buy. Technology, on the other hand, has alot to do with what we both buy and sell, and in the long run it is technology that will win markets, both in the U.S. and abroad.

Let me provide an example using what the U.S. government buys to illustrate my point.

The US Department of Commerce, conducted a study for the US Navy to develop a factual base for assessing the extent of the Navy's reliance on foreign supplier for critical components. They examined three naval weapon systems: the HARM missile; the Mark-48 ADCAP torpedo; and the Verdin communication system. The study focused on subtier suppliers to the three systems to examine whether foreign sourcing and dependency were greater lower down the supply chain.

The results of the study may surprise you. At the first tier - the prime contractors - all suppliers were American. However, at the second tier, the prime's immediate supplier of subsystems, the value of foreign sourced products was 10.1%. At the third or component tier, the value of foreign sourced components jumped to almost 14%.

If we examine Louisiana's participation in these procurements, we find that they fared better than 34 other states in receiving contract dollars for these three systems. Of the total subtier procurement dollars, Louisiana received 1.4%. However, two of our major trading partners fared better than the state. Canada received 2.4% and Japan 5.4% of the total subtier procurement dollars for these three systems. In addition, companies in over 30 other foreign countries received contracts under these systems. The Louisianna taxpayers' dollar for these weapon systems thus provided quite a few more jobs in foreign countries for every job it created in his or her home state.

This is the first and probably only time the subtier issue has been examined in hard detail by the Commerce Department. The

Department of Defense, and most other government agencies, award contracts to American firms without knowing the source of many of the subsystems and components that constitute the final product. Since the data, to a large extent, is not available, the problems of the subcontractor base in this country are often overlooked. The American Defense Preparedness Association completed a study in 1993 that concluded that the US subcontractor base is at serious risk due to the failure to modernize combined with declining end markets for their products.

This is a reflection on what is happening throughout industry, not just in the defense sector. For example, if you looked at the food chain of all industries versus focusing just on defense, you would be looking at one of the principle drivers of the merchandise trade deficit which stood at $132 billion in 1993 (up from $96 billion in 1992). If American companies continue to buy their subsystems and components off-shore, this deficit will continue to rise, as is predicted by industry forecasts.

Let me now examine the three main reasons listed in the study for sourcing off-shore. They are: higher quality products, lower priced products and better delivery time. These three reasons are all highly impacted by technology and they can be addressed if government and industry work as partners in the effort. If we examine the technology innovation cycle we can determine where our problems arise and the best way to address them.

The full innovation cycle is a lengthy and complex process. Its exact shape and form have changed over time. In its simplest form, an idea is generated, the idea is researched resulting in a prototype, the prototype is subjected to further development and engineering, a few applications are tried, after awhile more applications are explored and refinements are made, and ultimately widespread dissemination and utilization of robust technology occurs. Organizations with products that traverse the innovation cycle are on the road to competitiveness.

For a period in our history the beginning of the innovation cycle, i.e., the spawning of new ideas, was carried out in private laboratories like Thomas Edison's. This gave way early this century to corporate laboratories, like the Sarnoff Labs and Bell Labs. Recently we have witnessed a withdrawal by our leading companies from the operation of large corporate research facilities. In a globally competitive environment they are too costly to maintain. Today we are seeing research activities being scattered across a number of

organizations. In addition these organizations are devoting a much smaller percentage of their efforts and resources to exploring ideas where the commercial potential is yet undefined. Recent studies show one of the difficulties we are having is that for a given technology less that one percent of the organizations which should be involved, are involved or in many cases even aware of the research activities. On average, it takes about 25 years before the first one percent of our nation's manufacturers know that fruitful research has or is taking place.

The middle phases of the innovation cycle have remained fairly constant over time. Two types of organizations, i.e., food chain suppliers and early adopters, tend to become involved. Every new technology requires a food chain to support it. It evolves naturally, but at a very lethargic pace. Some suppliers become involved only to find that the market has not evolved rapidly enough to make a profit and warrant their continued participation. Many drop out, some re-enter in the future, and some new suppliers step in. The process is slow because not all the suppliers and support organizations begin at the same time, and few are able to develop their piece of the business at the pace required by others. The result is a plethora of changes and modifications leading to a very high cost to our nation due to the inefficiencies.

The second group involved during this period are the early adopters. Normally a cut above the average, their CEOs represent higher risk takers. They understand the potential advantages of a new technology, if only it can be made to work. They thrive on challenges and endure high levels of frustration. Some go back to the well many times - in essence betting everything if they fail, others are loathe to try again after a number of costly experiences. Eventually, a stable, robust technology with a supportive food chain evolves. By this time only 8 to 10 percent of our manufacturers have become involved with the new technology and another 20 years have transpired.

In the final phases of the innovation cycle, case studies, press exposure, education and training programs at all levels, a strong and diverse food chain supplier network, and robust technologies with a variety of cost effective applications facilitate widespread adoption. In a mere decade or so, a new technology will move like a wild fire through as much as 80 to 90 percent of industry. Two generations of Americans have past since the initial idea was generated, many new technologies including any number that could or have obsoleted that technology have been discovered, and in many cases our

trading partners are looking back at us. To be competitive, not only must a company bring technology through the innovation cycle, but it needs to do it quickly, at low cost and high quality, and in today's environment be highly flexible.

It's not a pretty picture. While a few technologies make the journey from idea to widespread utilization a little faster, many more take even longer. The questions are 'Why?', and 'Does this have to be?' The answers are not simple, but we know that many of our trading partners have dramatically improved on our process. They have built a technology infrastructure and supported it with industrial policies whereby these countries and their companies can more effectively compete against U.S. firms in the global marketplace as a world-class team.

Putting a technology infrastructure in place necessitates addressing each of three broad areas, business environment, workforce capabilities, and technology transfer tools in great detail. However, I plan to highlight just of few of the types of issues that must be examined. In *the first barrier area, the business environment*, all of our laws, policies, customs, etc., must be reviewed to ensure they are compatible with a "global" not solely a domestic environment. Few would meet the test. It is generally acknowledged the US business regulatory environment is more demanding than most. Unfortunately, this environment places a disproportionate burden on small and medium size organizations.

For instance, recall the length of time (i.e., 25 years) it takes to traverse the initial innovation stages. Neither our banking system nor our venture capital system is prepared to take on long range investments at these early stages. Government and industry must work closer together through these high risk stages. The trends around the world at the early innovation cycle stages are to incentivize collaborative efforts. By way of example, in Japan collaborative R&D activities are structured to encompass 2 to 5 percent of impacted organizations. (Note by involving many companies in the research phases, this collaborative approach reduces the innovation cycle time by 20 or more years.)

Even at mid innovation cycle stages our banking and venture capital system falls short. While a few food chain suppliers find venture capital, most do not. This alone drags out the cycle. However, more detrimental is the lack of capital throughout the banking system for investment in new and advanced equipment. Banks will not lend for new technologies. Generally, they do not know either the

companies or the technologies well enough to make informed lending decisions.

Given the limited financial strength on most small businesses, consider the difficulties, or more appropriately the impossibilities of growing sufficiently fast to meet market demand for a new technology. Our experience has demonstrated very few companies have access to sufficient capital to permit the type of expansion necessary to address evolving markets. As a result they impede market growth. This turns out to be equally true for technologies obtained through other organizations, like government laboratories, but with exclusive licenses. These small businesses cannot expand and they prevent anyone else from doing so. NCMS no longer permits exclusive license arrangements and relies on structuring multiple licenses with liberal financial and market incentives to encourage all involved. It works. It's shortening the innovation cycle mid phases.

By the way, we have also found that the absence of any aspect of the technology support supplier chain impedes deployment and adoption. So we try to start all the critical pieces in parallel. This is particularly true of maintenance and field support functions, and training and education activities. It is not easy to find all the organizations and all the resources necessary to begin all the activities when the market is infantile in nature, but if you do not the innovation cycle lengthens.

Let me address *the second barrier issue, workforce skills*, under a technology infrastructure. Let's face it, the technologies for which any of us were trained years ago, are not the technologies that will make us competitive today. Where is the training and education to upgrade our workforce going to come from? Consider a struggling small business, wanting to invest in new advanced technology to remain competitive. It has limited resources. The banks will not lend money for new technology. If by some miracle management finds the resources to purchase new equipment, no one on the payroll will be proficient in its use. If training and education could be afforded, it would be required for the staff that will design new products to be manufactured on it, for the technology operators, and for the maintenance staff just to mention a few. It will be months, possibly a year or more, before management can think about starting any return on investment. The challenge is too great for most organizations. I should point out that NCMS has encountered numerous manufacturing organizations where the training and education hurdle is so great that managements have

chosen to ride their current technology systems out of business. Nearly all of our trading partners have tools and processes where workforce skill and education upgrades are continuous and precede the introduction of new advanced technology to a company.

This leads me to *my final set of barriers, the lack of adequate tools and processes for effective and rapid technology transfer.* One of the reasons that it takes 25 years to reach the first one percent of our manufacturers and later it takes 20 years to reach the next 8 to 10 percent is awareness. This does not mean we need a system that sends more data to every CEO, quite the contrary they already have a data overload. Most receive more data in a week than they can handle in a month. What they need is quality, unbiased information. The best example that I can think of is a real-time industrial consumer's report that makes them aware of useful new services and technologies, lists the alternatives and sorts out the facts. With over 6000 commercial manufacturing processes (and even more service providers) changing all the time, no private organization, even our largest, has the resources to undertake an effort to bring order to this need.

If a small businessperson identified a technology that might be of value, there is no way to "kick the tires" prior to purchasing. The few instances where a businessperson could try a new technology in advance of final purchase were related to our trading partners dumping product or buying market share. Of course the negative side of these practices is that this Nation's technology suppliers who offer competing products, lose. For a businessperson to make the kinds of investments, opposed by bankers and requiring a high percentage of the company's precious resources, seeing a technology demonstrated or even better operating the technology on the types of products and in the environment in which it is to be used is essential. This is common practice in countries like Singapore, Japan and others. More simply stated, the lack of a set of integrated tools that facilitate involvement with a new technology throughout the entire innovation cycle presents an almost impossible hurdle to operations in a global business environment.

Closely related to technology and its need, are management practices. It is the rare organization which not only is aware of evolving practices, but also is able to adopt them. Again, it's a "kick the tires" type barrier for the management of a small organization. Consultants and service organizations come and go with every "fad" as well as beneficial practice. Sorting through the maze is too

demanding for all but the healthiest. The net result being those that have the greatest needs are least able to fulfill them.

Mr. Chairman, the NCMS believes that Congress now has before it in two bills, HR820 and S4, two very important programs that will help bolster our national technology infrastructure: the Advanced Technology Program and the Manufacturing Extension Program.

Both programs uniquely address the technology innovation shortfalls in the U.S. The Advanced Technology Program (ATP) establishes partnerships to perform collaborative research on high risk, long term projects. The NCMS has found the collaborative approach to be a more efficient, effective means to conduct R&D. ATP projects also require that a commercialization and deployment path or strategy be identified. This requirement might not be included if federal resources were not involved.

The Manufacturing Extension Program (MEP) is designed to address the needs of the small and medium sized U.S. manufacturer in the adoption of leading manufacturing technologies and principles. If designed correctly, this is the type of infrastructure program that also helps the manufacturing technology suppliers achieve awareness and deploy their products more efficiently and effectively. Whereas the ATP has expanded significantly over the past several years, the MEP has moved more slowly, yet deserves at least as much attention and support. It should be expanded to include technology demonstration type facilities, and it should be industry driven.

Conclusion:

Other Nations have worked with vigor and dedication to create a system where the government, academia and the private sector create a sustainable technology infrastructure. With this infrastructure, government purchases are made from a sustained local supplier network, larger businesses nurture and sustain their supplier base, and the supplier base ultimately is strong enough to compete in the global economy transplanting the supplier base of the U.S.

When American technology and manufacturing led the world we had no need to examine either efficiency or the methods of how technology was produced or how it was disseminated throughout our manufacturing base. We must now look to a means by which

87-667 O - 95 - 5

this technology, instead of merely being developed in the U.S., is assimilated and matriculated throughout our small and medium-sized manufacturing base. We must now work together to fashion the right mechanisms whereby technology transfer can occur, in an industry-led and sustained manner.

Mr. Chairman: NCMS believes the time has come for Americans in government, in academia, in labor and throughout industry to come together and resolve our conflicts and create a system, a National Technology Infrastructure to renew American competitiveness, and we encourage all to join in this effort.

I would be happy to answer any questions. Thank you.

Mr. HAYES. Thanks.

You have raised a couple of things that I get to see day-in and day-out and you phrased them in an excellent way. For example, when we made the decision not to go forward on as great a scale, there was comment made on mag-lev that the Japanese and Germans had done so much of the technology and that the technology was going to prove practicable for implementation, my view was we should do what they do and leap frog it. We should simply use their cost, zero that down, steal it and put it on line in Dallas. That is precisely what they do. If you take, for example, the Japanese example, with the CRAY–2 computer, they purchased a CRAY–2, tore it apart, copied it and rebuilt it. Which gets me to the question I want to ask, and that is intellectual property rights, which is another thing that we almost must be able to decide within any of our trade agreements or we will never be ultimately competitive in a fair marketplace. And that is one of the real stumbling blocks that we grapple with on all of our trade agreements, because until you are able to give some kind of security to intellectual property, then it does not make any sense for government to invest high on the high end, it makes much more sense for government's role in other countries to come on the distribution end of what you have just stolen.

And I would love to hear your comments on that because that has got to have a great play on where you invest money. If you start out where you can skip part one and jump to part three, I assure you you can be more competitive and much more efficient.

Mr. CUMMINS. I guess the general answer is yes. I mean intellectual property and the protection of that property is absolutely critical. But you know, not to downplay that issue, but technology, the pace of technological change now is moving so quickly. In the time it takes to back up and go through the system that it takes to protect that property, is just too slow. So anything we can do to put in place as a threat to anybody who would, you know, go after intellectual property, is critical.

I guess that is the bottom line. I personally have looked at this and said—I am almost to the point of saying they are coming after ours, we cannot protect it very well, we have to go after theirs. We do not do a very good job at that.

Let me just give you one quick example. It was about four years ago, we have our headquarters, as I mentioned, in Michigan, and I had flown back to Michigan for a meeting and I drove up to our office. Standing around the front of our building were about, I would say, 30 Orientals all with their—you know, typical black suits, white shirt, black tie, sunglasses, all with cameras. And they were all just taking pictures of our building. I did not know who these people were or where they came from. But it sent kind of a shock wave through my mind, I said what are they doing here. It was not too long after that when we had break-ins in the organization to find out what we do. We do not allow foreign companies to participate in our organization, it is strictly U.S. companies. They are constantly at the door trying to bang in to find out exactly what we are doing and where we are going.

I guess my overall feeling is on that, we need to do a much better job of at least initially benchmarking our foreign competition and

where they are at and then maybe taking some steps to access their technology.

Mr. HAYES. And the other point I wanted to cover, are examples that deal with what is an archaic relationship today between the Department of Defense and policy related to defense in marketplace commerce. For example, I sit through hours and hours of listening to lists of items that are prohibited to be sold in Europe that are being sold instead by the Germans and the French. We prohibited their sale only by us. And technology levels are therefore, once again in an extraordinarily non-competitive but nonsensical fashion, because if they truly are national security items, which most of them are not, the vast majority of those things may have been national security ten years ago, but are no longer. Now they are over-the-counter items that no longer could possibly add any competitive advantage on someone doing defense work, and yet our lists are so slow to catch up with what you are talking about on technological evolution. And since our list is so far behind, we end up with nonsense of seeing other countries that are our former NATO allies selling the precise product that we would be able to sell, therefore reaching the exact same marketplace, while we stand around and imagine that this is not happening. We are losing enormous amounts of revenue on what are non-crucial, non-critical and non-truly significant national defense items.

Let me run over to Al. I do not want to keep everybody longer, I want to make sure they get to lunch. Thank you very much for coming, I very much appreciate your presentation.

Well we are in your building, so I guess you ought to know something about it.

STATEMENT OF AL STEWARD, DIRECTOR, APPAREL CIM CENTER, THE UNIVERSITY OF SOUTHWESTERN LOUISIANA, LAFAYETTE, LA

Mr. STEWARD. Hopefully, Mr. Congressman. Mr. Chairman, I also appreciate the ability to offer testimony to the Committee today on I think an important area that at least I feel very close to based upon my personal nearly 20 years in the industry before joining academia here around five years ago.

I would like to clarify not only the need for technology development to address the problems in the textile industry, but also the importance of doing that rather quickly. As a preface, the apparel/textile industry in the United States really contains four components: The fiber production, textile mill products, apparel and of course the wholesale/retail.

This industry though comprises ten percent of the entire U.S. manufacturing work force. It has over 26,000 companies with the number of women and minorities employed twice the level of manufacturing in general. In 1989, the industry contributed $53 billion to the gross domestic product, ranking the industry second only to the aerospace industry.

For the decade of the 1980s as a whole, the textile/apparel imports increased ten percent per year. In the same decade, consumer demand for apparel increased about two percent a year.

At the end of 1991, the apparel industry employed just over one million people, the lowest level since World War II. This is 428,000 fewer jobs than in 1973.

Today, only half of the domestic apparel consumption is made in the United States. Imports are a reality and have forced domestic apparel manufacturers to look for new ways to compete. If current trends continue, it is projected that an additional one million jobs will be lost by the year 2002.

However, the superiority of U.S. productivity in manufacturing industries has been either matched or exceeded by foreign competitors, mainly Japanese and Europeans. There is an urgent need to develop new and advanced technology and to modernize manufacturing in the U.S. textile industry using advanced automated processes. The U.S. has a unique capability to do this by effectively mobilizing its advanced technology, its unparalleled depth and diversity of industrial structure, its entrepreneurial culture and the world's largest pool of trained scientists and engineers.

It is into this background that the A–CIM Center was established five years ago. We were uniquely established by the central trade association for the United States apparel industry, the American Apparel Manufacturers Association, and the state of Louisiana. The state of Louisiana provides, by far, the largest portion of the base line support for the operation of the center.

The specific purpose of course was to attack these challenges. The Apparel Center was established for the basic reason of addressing the barriers to CIM or computer-integrated manufacturing technology as a means to have the industry compete more effectively domestically and globally. Obviously this was our initial charge. As many of you have seen this morning in tours of the Center, our scope has broadened far beyond just CIM technology in addressing those areas that the industry itself indicates help is necessary in order for them to be able to effectively compete, and where we have the pool of resources able to adequately address that.

To this end, the Center has addressed major research projects that has improved the industry's ability to compete in the global marketplace and the Center acts as a technical developer of standards, as you have heard earlier, for the U.S. apparel industry and the U.S. textile industry under the American National Standards Institute, or ANSI.

As recognition of the Center's work increased, Memoranda of Understanding were executed with ATMI, the central trade association for the U.S. textile industry from which we have heard from Mr. Carlos Moore this morning, with TC-Squared, which you have heard about a nationally funded research development and technology transfer center for the U.S. textile and apparel industries. Also the Center's work has been recognized as highly beneficial by I think a very unique group, the Amalgamated Clothing & Textile Workers Union, the largest trade union for the United States apparel industry.

The A–CIM's research agenda is focused on providing solutions to a host of flexible automation and advanced manufacturing systems. Our objective is to improve the cost of production and achieve quick response through the agile manufacturing, which was earlier

mentioned, that will enable us to react to customer preferences. In order for the industry to effectively compete worldwide, a technology breakthrough must occur. Flexible automation techniques must be developed and implemented to produce a wide diversity of products in small quantities and at a reduced direct labor cost, thus providing quick response to changing customer demands.

The primary problem the industry faces is its inability to utilize new technology employed in other industries. The textile/apparel industry, unlike other industrial sectors in the United States, deals solely with materials that are limp in nature, deform easily, and lack precision of components such as semiconductor parts.

Based upon that, Mr. Chairman, I would like to address what I think the industry and we here at the Center feel that the best help the government could provide to us through your committee. In light of these problems, we ask the committee address the assistance in an urgent manner. Although the industry has over 26,000 companies employing over one million people, far less than one percent of these can afford their own research and development departments. The majority of these research and development departments are in the fiber area. Lesser numbers exist in the textile production and only a handful in the apparel sector. These industries need your support to remain competitive through viable research and development results. This industrial sector has had virtually no support for research and development through its history, although it is one of the earliest industries to be established in the United States. In the last ten years, federal assistance has become available to address the industry's needs. Although this assistance is greatly appreciated, the industry agrees that current levels are insufficient to accomplish the breakthroughs needed in the time required.

The precedence is well established as to the future of this industry if federal research and development assistance is not available. The related industries have been decimated. During the late 1960s and early 1970s the shoe industry was virtually eliminated in the United States. This resulted in subsequent elimination of an entire supplier chain, resulting in a permanent loss of several hundred thousand jobs. U.S. equipment suppliers to the textile/apparel industry have likewise vanished. This important area has been lost to European manufacturers and the Pacific rim countries. Even the Singer sewing machine company is now owned and operated by the Japanese.

We must avoid further loss of important textile and apparel manufacturing jobs in the United States through development of competitive technology. The solution is obviously not through artificial trade barriers, as we have talked about this morning. It is only through the establishment of a globally competitive industry that results from research and development efforts of combined federal, state, industrial and academic resources that the industry can survive. We feel confident this committee will address these needs in a manner that will maintain the employment base in textile and apparel manufacturing for the benefit of all Americans.

Thank you, Congressman Hayes.

[The prepared statement of Mr. Steward follows:]

TEXTILE TECHNOLOGY ADVANCES AT THE UNIVERSITY OF SOUTHWESTERN LOUISIANA APPAREL CIM CENTER

TESTIMONY OFFERED TO THE

U.S. HOUSE OF REPRESENATIVES

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

by AL STEWARD, DIRECTOR
USL APPAREL CIM CENTER
P.O. BOX 44932
LAFAYETTE, LA 70504

TEXTILE TECHNOLOGY ADVANCES AT THE UNIVERSITY OF SOUTHWESTERN LOUISIANA APPAREL CIM CENTER

INTRODUCTION

The U.S. textile/apparel industry contains four components: fibers, textile mill products, apparel, and wholesale/retail. The U.S. textile/apparel industry comprises 10% of the entire U.S. manufacturing work force. The industry has over 26,000 companies provide 1.8 million jobs with the number of women and minorities employed twice the level of manufacturing in general. With over $200 billion in U.S. annual consumer sales, the industry is the largest (23%) sector of non-durable goods manufacturing. In 1989, the industry contributed $53 billion to the Gross Domestic Product (GDP), ranking the industry second only to the aerospace industry.

For the decade of the 1980's as a whole, textile/apparel imports increased 10% per year. In the same decade, consumer demand for apparel increased about 2% a year. At the end of 1991, the apparel industry employed 1,010,000 people, the lowest level since World War II. This is 428,000 fewer jobs than the 1,438,000 employed in 1973.

Apparel imports increased an alarming 15% in 1992 from 1991, with an annual growth rate in apparel imports of 5.5% per year since 1987. This is well above the 2% annual rate of increase in consumer demand for apparel, resulting in an increased share of the U.S. market for imports. In 1980, domestically-produced apparel supplied 70% of the consumer needs. Today, only half of the domestic apparel consumption is made in the U.S. Imports are a reality and have forced domestic apparel manufacturers to look for new ways to compete. If current trends continue, it is projected that an additional one million jobs will be lost in the fiber/textiles/sewn-fabricated products industry by the year 2002.

The superiority of U.S. productivity in manufacturing industries has been either matched or exceeded by foreign competitors, mainly Japanese and Europeans. There is an urgent need to develop new and advanced technology and to modernize manufacturing in the U.S. textile/apparel industry using advanced automated processes. The U.S. has unique capabilities to do this by effectively mobilizing its advanced technology, its unparalleled depth and diversity of industrial structure, its entrepreneurial culture, and the world's largest pool of trained scientists and engineers. An unacceptable alternative would be the continued loss of apparel industry competitiveness in the global market place and progressive erosion of the U.S. quality of life.

THE NEED FOR TECHNOLOGY DEVELOPMENT

An analysis of the textile/apparel industry finds the textile segment to be significantly more advanced in automation and material handling technology. As a result, this segment of the chain is more effective in meeting global competition for its products. However its customer, the U.S. apparel manufacturer, significantly lacks advanced automation and systems technology and does not have sufficient capital to develop competitive technology on its own. Consequently, the labor-intensive manufacture of sewn and fabricated products in the apparel sector has been losing ground to offshore production. The apparel manufacturing industry has suffered greatly over the last two decades as swelling imports have come to dominate the U.S. market. While the market threat immediately and directly affects the apparel industry, it will have a major, though delayed, impact on the remaining links in the integrated textile industry supply chain. If labor economies force the apparel industry offshore, the logistics of raw material sourcing will similarly drive fibers and textiles industries closer to apparel manufacturing locations. The loss of U.S. apparel manufacturing is the most significant threat faced by all partners in the textile/apparel chain.

Currently, the industry loses over $25 billion annually due to products that are unsold or sold at deep discounts to liquidate inventory. In a fast changing, consumer-oriented, competitive industry, minimum finished goods inventory and work in process is advantageous. To be able to maintain a lower level of inventory, the industry must be able to guarantee quick response to given point of sales information. Guaranteed finished goods availability with short lead times and low inventory levels also require very low defect rates in raw material and finished goods. Integrated planning and scheduling at the detailed plant level are necessary for this effort. Logistical difficulties of offshore sourcing constitute a competitive advantage for U.S. manufacturers that can be exploited by achieving this *quick response* to consumer demands and thus, improving competitiveness.

Improved competitiveness results from increased productivity and yield. Since the competitive edge of offshore production results from the large difference in labor costs, automation must be considered as the means for increasing labor productivity. Efficient use of plant, material, labor and energy resources is a primary concern for both cost control and conservation. Increasing productivity/yield amortizes this expenditure over larger production or sales volume. Automation increases productivity and competitiveness, reduces reliance on offshore sourcing, and will restructure the textile/apparel job market.

Automation is the major force behind the rationalization of the production process to increase output per man-hour or output for a given set of production factors. The productivity impact of higher labor costs in the local market can therefore be offset with automation. Automation reduces all items that make up total

production cost, including:

- Reduction of labor cost per unit of production,
- Reduction of capital cost through reduction of in-process as well as finished goods inventory,
- Higher capital utilization through a higher degree of machine and plant utilization,
- Savings in energy and raw material,
- Faster product development, and
- Improved product quality.

Two key concepts for successful automation are flexibility and integration. Flexible automation allows re-configurability of the production system to manufacture several different products and product variants, achieving high degree of machine utilization and low degree of in-process inventory, as well as short response time to changes in consumer preferences. Integration provides a well-balanced material and information flow system which results in the production of the right amount of goods at the right time for demand, thus, achieving quick response.

Additionally, the textile industry is the tenth most energy-intensive process industry in the U. S., consuming 5.5% of the total industrial energy usage. It ranks sixth after Paper, Chemical, Glass, Metal and Petroleum industries in Energy Intensity Ratio, or energy utilization per dollar value of shipments. Energy sources for the industry generally include natural gas, coal, oil and electric power used in boilers, chillers, dryers, etc. There has been a concerted effort in the industry to develop energy accounting systems and establish an energy consumption standard. A major portion of power costs is a fixed cost component in the operation of a production facility. Therefore, measures to increase productivity over time will amortize the energy costs over a larger volume. From this point of view, productivity enhancement through automation, though motivated directly by labor productivity considerations, will also contribute to energy efficiency. Innovations and improvements in process technology that directly impact energy consumption and environmental quality are also required in the textile/apparel industry.

THE A-CIM CENTER

Background

For the specific purpose of meeting these challenges, the Apparel CIM (A-CIM) Center was established in 1988 through an agreement between the American Apparel Manufacturers Association

(AAMA), the central trade association for the U.S. apparel industry, and the state of Louisiana. The Center is located at the University of Southwestern Louisiana, in Lafayette, Louisiana, due to the nationally recognized expertise of the University in computer science and computer engineering disciplines. The short-term mission of the Center was to identify the barriers to wide spread CIM (Computer Integrated Manufacturing) implementation in the U.S. apparel industry and to recommend solutions to those barriers, where feasible.

To this end, the A-CIM Center has addressed major research projects that have improved the industry's capability to compete in the global market place through enhanced use of CIM technology. Additionally, the A-CIM Center acts as the technical developer of CIM standards for the U.S. apparel industry under the American National Standards Institute, ANSI. As recognition of the Center's work increased , Memoranda of Understanding (MOU) were executed with the American Textile Manufacturers Institute (ATMI), the central trade association for the U.S. textile industry, and with the Textile/Clothing Technology Corporation [TC]^2, a nationally funded research development and technology transfer center for the U.S. textile and apparel industries. Also, the A-CIM Center's work has been recognized as highly beneficial to the industry by the Amalgamated Clothing and Textile Workers Union, the largest trade union for the U.S. apparel industry.

Facilities

A unique characteristic of the USL A-CIM Center is that it houses over eight million dollars ($8,000,000) of equipment. A Virtual Reality lab has been established to determine how the new and exciting developments in virtual reality can best be applied to apparel and related industries. The lab is equipped with four Silicon Graphics workstations including an Onyx Reality Engine, the world's fastest graphics processor. The machines are networked together, and to other machines on the university's campus allowing for easy access and exchange of information. This state of the art virtual reality equipment can be used for research in many diverse areas including apparel, medicine, chemistry, education, and architectural design.

A Robotics and Automation Laboratory(RAL) has been established for research in the areas of Robotics, Advanced Automation, Real-time Control, Vision, and Intelligent Machines. Efforts are aimed at developing the theory and prototypes of intelligent machines capable of accomplishing a variety of complicated tasks in uncertain environments. This can be achieved by minimal supervision and intervention of a human operator. The RAL continues to promote research in the areas of Robotics and Advanced Automation as a service to the scientific and industrial community.

The Computer Aided Design (CAD) Lab utilizes high technology CAD software which provides creative apparel designing, pattern

designing, grading, and marker making systems. In addition, the systems offer instant scanning ability, multi-color selections which allow millions of color swatches to be made, automatic storing capacity, custom reports, and spec sheets. These software packages allow designers, pattern makers, merchandisers, and stylists to perform with flexibility, speed, and accuracy. Thus, cutting design time from weeks to minutes.

The Computer Aided Manufacturing (CAM) Lab includes a computer controlled unit production system, a fabric spreader, a fabric cutter, various sewing/pressing machines, and a state-of-the-art computer networking facility to integrate robotics, vision and other systems.

Research Agenda

The A-CIM Center's research agenda is focused on providing solutions to a host of flexible automation and advanced manufacturing systems, with the objective of improving the cost of production and achieving quick response to consumer preferences.In order for the textile/apparel industry to effectively compete worldwide, a major technology breakthrough must occur. Flexible automation techniques must be developed and implemented to produce a wide diversity of products, in small quantities and at a reduced direct labor cost, to provide a quick response to changing customer demands. The primary problem the textile/apparel industry faces, is the inability to utilize new technology employed in other industries. The textile/apparel industry, unlike other industrial sectors in the U.S., deals solely with materials that are limp in nature, deform easily, and lack precision of components such as semi-conductor parts.

Academic Resources

The A-CIM Center uses a cross-disciplinary approach to involve, and utilize the expertise and resources of other USL departments for research and problem solving. USL's internationally recognized Computer Science and Computer Engineering graduate programs at the Center for Advanced Computer Studies provide assistance to the A-CIM Center in applying the latest computer technology in project development. Areas of expertise include Artificial Intelligence, Very Large Scale Integration (VLSI), Computer Vision and Pattern Recognition, Multimedia, Virtual Reality, and Robotics.

The USL department of mechanical engineering has a strong program in traditional areas which include machine design, heat transfer, and vibrations, but it also includes a new rather unique option in computer aided design and manufacturing. The department provides assistance to the A-CIM Center with current projects dealing with the development of CIM technology and robotic manipulation of limp fabric pieces.

The A-CIM Center has and will continue to play a leading role in the attempt to revitalize the textile\apparel industry by developing solutions for apparel manufacturing problems. The Center has undergone several major research projects that have improved the industry's capability to compete in the global market place. In order for technology breakthrough to continue, flexible automation techniques must be developed and implemented to allow manufacturing of small quantities, wide diversity of products at a reduced labor cost, and to facilitate a quick response to changing customer demands.

The primary problem that the industry faces is the inability to utilize new technology employed in other industries to improve industrial competitiveness. This industry,unlike others in the U.S., deals solely with materials that are limp in nature, deform easily, and lack precision of components such as semi-conductor parts. The A-CIM Center conducts fundamental and applied research that will bring advances in computer and other scientific technologies to bear on this problem.

Current Problems Being Addressed

The A-CIM Center has had great success in providing research, development, and technology transfer for the benefit of the U.S. apparel/textile industry. This is witnessed by the variety of programs and activities the Center has undertaken. The Center has a number of grants funded by federal and state agencies. Each of these grants allow research in critical areas in the apparel industry. Target research areas include CIM implementation in an apparel plant, event-driven simulation of an apparel plant, apparel plant layout design, and fabric manipulation with a microactuator robotic gripper. Expertise in such diverse fields as virtual reality, multimedia, mechanical engineering, rule-based knowledge, and robotics are being used to complete these projects.

One of the problems the industry faces in achieving manufacturing competitiveness is the lack of standards for communication among the various pieces of equipment utilized in apparel and textile manufacturing. The ability to communicate to and among manufacturing equipment dramatically facilitates a company, or an industry's capability to provide quick response to market dynamics on a global basis. This communication allows new product introduction to occur in a much shorter time frame than normally possible. In addition, "fine tuning" of equipment is facilitated through the continuous monitoring of performance and the ability to remotely change certain perimeters utilized by the equipment. The implementation of this concept provides the computer integrated manufacturing or CIM for which the Center is named. CIM technology has provided dramatic benefits to other industries, primarily hardgoods. The CIM concept has allowed quick changes to new technology development in the semi-conductor industry as well as automotive and aerospace.

The A-CIM Center is addressing the standards required for CIM

implementation in the textile/apparel industry. The Center has been named by both the American Apparel Manufacturers Association and the American Textile Manufacturers Institute as their technical developer of CIM standards under the American National Standard Institute, ANSI. The various standards established to date have had a positive impact on the industry and its equipment suppliers. Unfortunately, many of the equipment suppliers are based in Europe and the Far East. However, their willingness to embrace and implement these standards has lead to truly international recognition.

The Center's Robotics and Automation Laboratory has been funded to address the problems in pick up and position of apparel components. Unlike the hardgoods industry for which robotics are playing an increasingly important role, the specific properties of the material utilized in apparel manufacturing present barriers to wide spread robotic implementation in the industry. Specifically, the material easily deforms upon pick up, is difficult to place and maintain symmetry (wrinkle-free), and is subject to surface deformity (holes and tears) when grasped by mechanical "fingers". The Center's success in developing a gripping device for existing industrial robots has been highly regarded by the funding agencies and the industry at large. The Laboratory is currently improving on the existing prototype and expects to begin joint commercial development within the next 18 months. A fundamental problem affecting the use of robotics appears to have been solved by the University of Southwestern Louisiana's Apparel CIM Center. Further modifications and adaptations to this basic concept will be required to satisfy a broad implementation of this technology.

The Center has also been active in virtual reality and multi-media research and development. Federal, state and industrial funds have been utilized to develop a "virtual plant" environment. This virtual plant allows an engineer to "walk through" a plant and add or move equipment as necessary for new product introductions. This greatly simplifies the reconfiguration of a plant to accept new styles and ensures the proximate location of necessary utilities such as power, air, and vacuum. As the Center refines this technology, the cost of the hardware base required will be reduced as computer technology continues its increase performance at decrease prices.

Recent equipment acquisitions are now positioning the Center to address fundamental problems in remote garment purchases, i.e., catalog and home shopping network services. The Center will be addressing the issues of fit, mobility and comfort as well as the accurate rendering of fit for a broad range of apparel. The Center envisions this technology to initially provide kiosk type rooms at retail stores to allow customers to "try-on" a broad range of apparel to validate fit and other considerations required to make a purchase decision. Obviously, this technology can represent both garments available in the store as well as those temporary unavailable. Future technology development and decreased hardware costs are envisioned to facilitate truly in-home shopping through

the proposed information highway to be made available.

Industrial Assistance Program

Since its inception, the A-CIM Center has been active in economic development for the benefit of textile/apparel industry in the state and the region. The Center views economic development as a two-fold issue. First, is the necessity to maintain the health and well being of our current industrial base. This can only be accomplished through an in-depth understanding of the problems and challenges these companies face and how technology development can make these companies more competitive. The second issue involves the attraction of new industry to the region that can benefit from close proximity to technology development.

The state of Louisiana recognizes the importance of the textile/apparel industry. Its largest private employer, with over 7,000 manufacturing jobs, is a textile/apparel company, Fruit of the Loom. There are over 100 textile/apparel companies officially operate in the state. In addition to the strong dependency the state has on textile/apparel manufacturing jobs, the state's agricultural efforts produce over one million bales of high-quality cotton annually. The state of Louisiana, through its Department of Economic Development, provides broad support in both maintaining of its current businesses as well as the attraction of new.

The A-CIM Center has an operational outreach program for Louisiana apparel manufacturers and suppliers. This outreach program provides assistance in exploring automation benefits, evaluating manufacturing processes and furnishes pre-production services. Additionally, the program works in cooperation with the Louisiana Department of Economic Development and other regional development agencies providing expertise and a research base to attract additional apparel manufacturing facilities to Louisiana.

REQUESTED SUB-COMMITTEE ASSISTANCE

It is in light of the aforementioned problems the textile industry faces that we ask this committee to provide additional assistance. Although the industry has over 26,000 companies employing over 1,000,000 people in manufacturing jobs, far less than one percent of these can afford their own research and development departments. The majority of these are in the fiber area, lesser numbers in textile production and only a handful in the apparel sector. These industries need your support to remain competitive through viable research and development results. This industrial sector has had virtually no support for research and development through its history although it is one of the earliest industries to be established in the U.S. In the last ten years, some federal assistance has become available to address the industry's needs. Although this assistance is greatly appreciated, the industry agrees that current levels are insufficient to

accomplish the breakthroughs needed.

The textile industry problem is further compounded by the diversity and number of companies involved in manufacturing. The diversity is represented in the various products produced each having particular automation needs and also in the geographical location of the manufacturing plants. Thus, it is important to have multiple centers for demonstration and research to reach the industry effectively and to address their specific regional needs.

The precedence is well established as to the future of this industry if federal research and development assistance is not available. The related industries have been decimated. During the late sixties and early seventies, the shoe industry was virtually eliminated in the U.S. This resulted in the subsequent elimination of the entire supplier chain resulting in the permanent loss of several hundred thousand jobs. U.S. equipment suppliers to the textile/apparel industry have likewise vanished. This important area has been lost to European manufacturers and the Pacific rim countries. Even the Singer sewing machine company is now owned and operated by the Japanese.

We must avoid the further loss of important textile and apparel manufacturing jobs in the U.S. through the development of competitive technology. The solution is obviously not through artificial trade barriers to prevent foreign competition. It is only through the establishment of a globally competitive industry that results from the research and development efforts of combined federal, state, industrial and academic resources that the industry can survive. We feel confident this committee will address these needs in a manner that will maintain the employment base in textile and apparel manufacturing for the benefit of all Americans.

Mr. HAYES. Thanks very much.

Clearly this facility, and as I said earlier to some of the news media, despite how well it is known in its complexities by the handful of folks who are in day-to-day connection with it, it is still too well kept a good secret. And for that reason, I hope that our presence here today and the committee staff and some of the people that we have had down here expand that knowledge, and I really saved Bill Fenstermaker for last because he fits appropriately into, in his role as President of the Lafayette Chamber of Commerce, he fits appropriately into the business community's initial role, which I think is to disseminate information, both to disseminate information about what is here and to create a program that I have been very impressed with and that my chief of staff John Doyle is very high on what he is about to describe on the Acadiana Hot Link. That continued message has got to reach initially, just outside this building, where still too many people do not realize that we are here, and then hopefully make the connections to major industrial base, which we have had some examples of, and then finally, the third link in that partnership, back to some of the federal people who are aware of names but not places until they have an opportunity to see them.

So Bill, it is very much my pleasure to close this hearing with your testimony and I would call everyone's attention to the fact that I think this is just a great idea that you are going to explain in some detail to us.

So thanks again for being here representing both your own company and in your role as President of the Lafayette Chamber of Commerce.

STATEMENT OF WILLIAM H. FENSTERMAKER, FENSTERMAKER & ASSOCIATES, LAFAYETTE, LA

Mr. FENSTERMAKER. Thank you. It is going to be quite obvious to all of you that I am not an expert in either textiles or aerospace, but I appreciate being asked to be here.

I am here today to testify on behalf of the Greater Lafayette Chamber of Commerce, and what I would like to do is reveal to this Subcommittee the cooperative efforts that are underway between this university, the University of Southwestern Louisiana, and the regional business community called Acadiana.

In the early years of this country, settlements were founded and flourished along the coast and along rivers because of the availability of good transportation. Then came the industrial revolution and growth began to follow modern means of transportation—roads, railroads, and air corridors.

Today, in the information age, access to information and the exchange of knowledge are the keys to success and prosperity. Only with an adequate facility in place to transport these precious commodities can this state and region better coordinate its activities to meet the challenges and changes in an increasingly competitive global marketplace.

To respond to these dramatic changes, the Greater Lafayette Chamber of Commerce has made it the highest priority of our Long Range Planning Division, and next, and beyond that, to redefine the connection between the business community and our University

and to explore synergies in the exchange of ideas, information, and technology.

In my Chamber Banquet speech in January of this year, I said "Our vision is for business to partner with USL, to introduce a new model of communications throughout this region called Acadiana. This will establish a link between business and education that will allow each to benefit from, and to improve the other." We call this linkage Acadiana Based Computer Network, "Acadiana Hot Link". It is to employ new and emerging technologies, particularly high speed asynchronous transfer mode switches and fiber-optics, to make USL the on-line host for interactive business communications.

There will be a broad range of benefits in the area of economic development by linking USL's advanced computer center, Apparel CIM Center, and other centers of excellence that the University has to its business partners in Acadiana and also to the world markets. Some specific benefits of Acadiana Hot Link will be to create a state of the art telecommunication backbone that is crucial to maintaining and attracting high tech business and industry. It will enhance USL's education mission, an important factor in recruiting industry and training the work force as management and production needs change. It allows companies to train employees at local sites with college and university course offerings through on-line connections to the work location. It helps link smaller Acadiana manufacturing companies to larger, national companies which are customers for component products. It will give business better access to strategic information and market data through worldwide networks. It will promote the location of industry throughout the region, rather than just in large metropolitan areas. It also allows medium-sized start-up businesses to overcome knowledge and access barriers through flexibility, adaptability and cost efficiency of advanced telecommunications access.

Since January, we have been somewhat quiet, however, since this announcement we have been working very efficiently behind the scenes to make this information highway a big success. We have focused on the health care industry, because of the immediate needs and complex data model associated with that industry. A symposium is scheduled at this University, possibly on August 2nd revealing to our regional medical institutions the advantages that Acadiana Hot-Link will have in carrying out the delivery of advanced and efficient health care. Following that meeting in the near future will be introductions of this network to our financial services industry. Both of these industries will lead up to our on-line availability to all of the businesses in Acadiana.

Our strategy has been based upon on obtaining funding from private sector sources with matching grants from state and/or federal government. By funding Hot Link in this fashion, we feel it essential to deliver benefits immediately to our funding sources. Our plan is intended to accomplish this goal.

Let me conclude my remarks by saying that there has always been a rich history of cooperation between the University of Southwestern Louisiana and the Acadiana business community. Our goal has been to strengthen that relationship. We recognize that to thrive in, or even to take part in, the new global economy, it will

be important to introduce new concepts and strategies into our business plans. This business transformation makes re-training and continuing education continuingly and increasingly important—and who could be better poised to provide that than USL, to help us keep pace with these changing times.

I thank you for the invitation.

[The prepared statement of Mr. Fenstermaker follows:]

Testimony of William H. Fenstermaker

President of the Greater Lafayette Chamber of Commerce

appearing before the

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

I am here today to testify on behalf of the Greater Lafayette Chamber of Commerce -- to reveal to this Subcommittee the cooperative efforts underway between the University of Southwestern Louisiana and the regional business community of Acadiana.

In the early years of this country, settlements were founded and flourished along the coast and along rivers because of the availability of good transportation. Then came the industrial revolution and growth began to follow modern means of conveyance -- roads, railroads, and air corridors.

Today, in the information age, access to information and the exchange of knowledge are the keys to success and prosperity. Only with an adequate facility in place to transport these precious commodities can this state and region better coordinate its activities to meet the challenges of a changing and increasingly competitive global marketplace.

To respond to these dramatic changes, the Greater Lafayette Chamber of Commerce has made it the highest priority for it's Long Range Planning Division to redefine the connection between business and our University and to explore synergy's in the exchange of ideas, information, and technology.

In my Chamber Banquet speech in January of this year, I said "Our vision is for business to partner with USL - - to introduce a new model for communications throughout this region called Acadiana. This will establish a link between business and education that will allow each **to benefit from**, and **improve the other**."

We call this Acadiana Area Computer Network, **"Acadiana Hot Link"**.

It will employ new and emerging technologies, particularly high speed asynchronous transfer mode switches and fiber-optics, to make USL the on-line host for interactive business communications.

There will be a broad range of benefits in the area of economic development by linking USL's advanced computer center, Apparel CIM Center, and it's other centers of excellence to business partners in Acadiana and to the world markets. Some specific benefits of the Acadiana Hot Link:

- It will create a state of the art telecommunication backbone that is crucial to maintaining and attracting high tech business and industries.
- It will enhance USL's education mission, an important factor in recruiting industry and training the workforce as management and production needs change.
- It allows companies to train employees at local sites with college and university course offerings through on-line connections to the work location.
- It helps link smaller Acadiana manufacturing companies to larger, national companies which are customers for their component products.
- It will give business better access to strategic information and market data through worldwide networks.
- It will promote the location of industry throughout the region, rather than just in metropolitan areas.
- It allows small, medium-sized start-up business to overcome knowledge and access barriers through flexibility, adaptability and cost efficiency of advanced telecommunications access.

WHERE ARE WE NOW ...

Since our announcement in January, many things have been happening behind the scenes to make sure the Information Highway is a success. Focus has been put on Health Care, because of the immediate needs and complex data model associated with that industry. A symposium is scheduled for August 2nd at USL revealing to our regional medical institutions the advantages that Hot-Link will have in carrying out the delivery of advanced and efficient health care. Following that meeting in the near future will be introductions of the network to our Financial Services industry. Both of these leading up to the on-line availability to all of the businesses in Acadiana.

Our strategy is based on obtaining funding from private sector sources along with matching grants from state and/or federal government. By funding Hot Link in this fashion, we feel it essential to deliver benefits immediately to our funding sources. Our plan in intended to accomplish this goal.

Let me conclude my remarks by saying that there is a rich history of cooperation between the University of Southwestern Louisiana and Acadiana's business community. Our goal is to strengthen that relationship. We recognize that to thrive in, or even to take part in, the new Global Economy, it will be important to introduce new concepts and strategies into our business plans. This business transformation makes re-training and continuing education increasingly important. ...and who could be better poised than U.S.L., to help us keep pace with these changing times.

Mr. HAYES. Thanks very much.

I am going to close the hearing on this note. We had an opportunity today, through a wide variety of angles, to look at the means by which we can link the appropriate role of government to spend dollars in their most efficient and productive manner for the benefit of the people who ultimately are the source of power for which government attains that position.

Secondly, with a business community that in international and global competition quite often finds itself competing against a role in which government and business linkages in systems that are not as democratic as ours nevertheless result in a competitive advantage, or to put it in very simple terms—John D. Rockefeller did not bring about legislation on anti-trust because he was not good at what he did, he brought about legislation on anti-trust because it was undemocratic and worked extremely well. If you then impose upon other countries an obligation to do the equivalent, you find that we do not have that prerogative, even as a super power. Therefore, what we must do is recognize that we have got to maintain the essence of democracy while still creating other forms of the same kind of linkage that allowed him to produce better and more efficiently, although violating the rights of other companies in closing them down.

What you are looking at today is a model that has grown up of a partnership that works without costing anyone the ability in this country to work hard and do well, to do startup industries and to do what has been our trademark across the world, and that is small companies that grew bigger, family operations that could prosper. We can in fact do both and the partnership which you witnessed is part of it.

Secondly, and something of which I am extraordinarily proud, while the vast majority of Americans looked on television screens in a circumstance in which the weapons of war were demonstrated, the technology which they viewed, even in its extraordinary nature, was thought to them to be able to be converted into private use as well. Some of that you have heard about today. But what I look at mostly, at the time of the Gulf War, was something that most Americans have never had a chance to see, but which I am going to make sure in the upcoming months they have the opportunity to witness for the first time. Part of the time of that Gulf War was spent for me at the National Institutes of Health, where I watched from Bethesda, Maryland, as young men who had been injured on the battlefield, through the use of a linkup satellite, through display panels at the National Institutes of Health, were having lab work done and blood samples analyzed and then on some occasions experts from across the country make instant judgments relayed back to surgeons in the field. The linkage between the Mayo Clinic, for example, and the National Institutes of Health, over a live satellite transmission, led to a decision that was made regarding a disease contracted in the desert in less than 30 minutes.

As I watched the President of the United States stand on what had been the carnage 50 years ago on D-Day, I thought to myself, though both of those instances represented the horror of war, in each case something grew from it. In the first instance was the realization that this country had worked awfully hard together to

preserve its democratic processes, and in the aftermath of that war under the Marshall Plan rebuilt Europe, creating for us the greatest market opportunity in this country's history and advancing us to the preeminence which we still hold today.

And in a second war which I had observed, which was highlighted by its technology, was indeed the same ability to once again use the opportunities around the world to make American technology and its products the most accessible, the most cost-beneficial and while at the same time preserving the role that each and every American has in their own government.

I think that it is astonishing to recognize that we can indeed to just as impossible a feat as it seemed to be to retake the beaches of Normandy and that is to continue to develop the highest quality at the lowest cost through our own technology.

Thanks very much for attending, I hope you enjoyed it and I hope that each and every one of you, whether you have been here 100 times or this is your first, saw something else at this center for technology that enhances the view of USL in our community and across the nation. Thanks.

[Whereupon, at 1:00 p.m., the subcommittee was adjourned.]

APPENDIX

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
INVESTIGATIONS AND OVERSIGHT SUBCOMMITTEE

OPENING STATEMENT OF
CONGRESSWOMAN CONSTANCE A. MORELLA
RANKING MEMBER

FIELD HEARING ON TECHNOLOGY-BASED ADVANCES IN MANUFACTURING
UNIVERSITY OF SOUTHWESTERN LOUISIANA
LAFAYETTE, LOUISIANA

JULY 7, 1994

Mr. Chairman, I commend you for your leadership in calling for this field hearing on technology-based advances in manufacturing. I am pleased that you will be focusing on two of the most important primary industries in Louisiana's seventh congressional district -- textiles and aerospace. Due to scheduling conflicts, I apologize that I am not able to join you to hear the testimony of our distinguished witnesses this morning.

I share, however, your deep concern about our international competitiveness. The issues which you will discuss today are of great importance not just in Louisiana and my home district in Maryland, but for our nation as a whole. Bolstering our nation's ability to compete in the global marketplace is, perhaps, the major linchpin to our nation's continued economic well-being.

One vital facet of our international competitiveness is retaining our American technological preeminence in manufacturing. This hearing will aid the committee in our efforts to identify the best means for promoting advances in manufacturing technologies. It will also provide us with an opportunity to view the impact and potential benefits of federal research and development programs and policies on those industries.

Mr. Chairman, I wish you great success in today's hearing. I apologize once again for my inability to attend. You have assembled a blend of government and private sector witnesses that should make for a very informative and productive hearing. I look forward to reviewing the transcript and the testimony of all the witnesses upon your return to Washington.

87-667 (152)

ISBN 0-16-046952-X